

**EXHIBIT 17**  
**FILED UNDER SEAL**

*HIGHLY CONFIDENTIAL – SUBJECT TO PROTECTIVE ORDER*

**UNITED STATES DISTRICT COURT  
FOR THE EASTERN DISTRICT OF TEXAS  
SHERMAN DIVISION**

THE STATE OF TEXAS, ET AL.,

*Plaintiffs,*

v.

Case No. 4:20-cv-00957-SDJ

GOOGLE LLC,

*Defendant.*

**EXPERT REPORT OF DR. ANINDYA GHOSE**

**July 30, 2024**

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## I. INTRODUCTION

### A. Qualifications

1. I am the Heinz Riehl Chair Professor of Business at New York University's Leonard Stern School of Business (NYU Stern), where I hold joint appointments as Professor of Technology, Operations, and Statistics and Professor of Marketing. I also serve as the Academic Director of the Master of Science in Business Analytics (MSBA) program at NYU Stern. I have also served in a variety of other capacities at NYU, including as Director of the Center for Business Analytics, Co-Director of the Center for Digital Economy Research, Co-Director of the Master of Science in Business Analytics Capstone, and Co-Chair of the NYU-AIG Partnership on Innovation for Global Resilience. I have been a visiting professor at the Wharton School of the University of Pennsylvania.

2. The principal focus of my research and teaching at NYU Stern has been analyzing the economic consequences of the internet and mobile technologies on industries, firms, and markets transformed by digitization. I have worked on economic issues arising in digital platforms, data privacy, digital marketing, mobile advertising, advertising technology (ad tech), and social media, among several other topics, using methods from statistics, game theory, econometrics, industrial organization, machine learning, and data science, among others. My research has been published in peer-reviewed scientific journals such as *Management Science*, *Information Systems Research*, *Marketing Science*, *Journal of Marketing Research*, *Journal of Marketing*, and *MIS Quarterly*, among others. In total, I have published more than 120 research articles in premier scientific journals and peer-reviewed conferences. I have also co-authored more than 110 workshop articles. This work has been cited by researchers in marketing, information systems, economics, and computer science over 22,400 times.<sup>1</sup> In 2019, I was recognized by the Web of Science citation index in the top 1% of researchers. My research was cited in the 2023 Economic Report of the President published by The White House.<sup>2</sup>

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<sup>1</sup> As of July 29, 2024. See author profile on Google Scholar at <https://scholar.google.com/citations?user=oQHsB5kAAAAJ&hl=en>.

<sup>2</sup> "Economic Report of the President," *The Council of Economic Advisers*, March 2023, available at <https://www.whitehouse.gov/wp-content/uploads/2023/03/erp-2023.pdf>, at p. 216.

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3. I have received 27 best paper awards and nominations for excellence in research from various journals, conferences, and workshops. I have been the Ph.D. advisor or co-advisor to multiple Ph.D. students whose research papers (co-authored with me) have won the Best Dissertation awards or Best Paper awards. My student Professor Beibei Li won the 2013 INFORMS Information Systems Society (ISS) Nunamaker-Chen Dissertation Award, the 2013 Herman E. Krooss Doctoral Dissertation Award, and the 2012 ACM SIGMIS Doctoral Dissertation Award for her thesis on analyzing consumer behavior on product search engines and social media platforms that I co-advised. My Ph.D. student Professor Chenshuo Sun was the recipient of the INFORMS ISS Nunamaker-Chen Dissertation Award in 2022 and the NYU University-wide Outstanding Dissertation Award for his thesis on the emerging technologies including the integration of omnichannel marketing that I advised. I co-authored papers relating to these dissertations. A paper I co-authored with my Ph.D. student Professor Vilma Todri on measuring advertising effectiveness and causal inference in different kinds of digital advertising campaigns (including display advertising) won the 2021 Best Paper Runner-up award in *Information Systems Research*. Another paper I co-authored with Professor Todri on digital advertising attribution (including display advertising), published in *MIS Quarterly*, was a finalist for the INFORMS CIST 2015 Best Paper award. I have several papers on measuring advertising effectiveness and causal inference in different mobile advertising targeting techniques, including one with Professor Li that won the 2020 Best Paper Runner-up award in *Management Science* and another one (published in *Marketing Science*) with a former Ph.D. student Professor Michelle Andrews on measuring the positive impact of mobile ad targeting on sales that won the Best Overall Conference Paper award at the 2014 American Marketing Association conference.

4. My book *TAP: Unlocking the Mobile Economy* is a double-winner in the 2018 Axiom Business Book awards. It illustrates how firms can leverage the highly granular, consumer-level data generated from smartphones and related digital technologies to offer various kinds of targeted digital advertising in a manner that benefits both firms and consumers. It also analyzes various economic issues related to effectiveness of mobile advertising and consumer preferences with respect to data privacy. The book has been translated into five languages so far. I have another book forthcoming in 2024 to be published by MIT Press, titled *Thrive: Maximizing Well-Being in the Age of AI*.

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5. I have received numerous awards, honors, and recognitions including the INFORMS ISS Distinguished Fellow Award, which recognizes individuals who (i) have made outstanding intellectual contributions to the discipline with publications that have made a significant impact on theory, research, and practice, and (ii) contributed to the intellectual stewardship of the field as reflected in the mentoring of doctoral students and young researchers. In 2014, I was named by Poets & Quants as one of the Top 40 Professors Under 40 Worldwide. In 2017, Thinkers50, the premier ranking of global business thinkers, recognized me as one of the top management thinkers most likely to shape the future of how organizations are managed and led. In 2020, I was recognized by the INFORMS ISS with the inaugural Practical Impacts Award. This award honors academics who have demonstrated outstanding leadership and sustained impact on the industry by deeply influencing practitioners, managers, executives, and policymakers using their academic research. In 2022, I received the AIS Fellow Award from the Association of Information Systems, which recognizes individuals who have made significant global contributions to the information systems discipline as well as outstanding local contributions in the context of their country and region. In 2022, I also became the youngest recipient of the Distinguished Alumni award from the Indian Institute of Management, Calcutta in its 58-year history.

6. I am currently the Department Editor of *Management Science* for Information Systems. In the past, I have served as a Senior Editor of *Information Systems Research* and Associate Editor of *Management Science*. I am a winner of the National Science Foundation's (NSF) CAREER award, their most prestigious award in support of junior faculty who "have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization."<sup>3</sup> I have received competitive grants from the NSF, Google, Microsoft, Adobe, Marketing Science Institute, Wharton Customer Analytics Institute, and the Networks, Electronic Commerce, and Telecommunications Institute in recognition of my research.

7. I have consulted in various capacities for many firms including Alibaba, Apple, W. R. Berkley Corporation, CBS, Dataxu (acquired by Roku), Delhivery, DFS Group, EYWAMEDIA,

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<sup>3</sup> "Faculty Early Career Development Program (CAREER)," *National Science Foundation*, available at [https://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503214](https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503214).



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Facebook (now Meta), Fox Corporation, Google, HR Ratings Mexico, iBUS, IBM, Lucidity, Marico India, NBCUniversal, Netcore Cloud, OneVest, Pinterest, Revenue Roll, Samsung, SHOWTIME, Snapchat, TD Bank, Tamoco, Tinder, Verizon, Yahoo, ZeroWeb, 1-800 Contacts, and 3TI Solutions. I have also collaborated on research projects with many firms including Alibaba, China Mobile, C3 Metrics, Indiegogo, iQIYI, Microsoft, RecoBell, Shinsegae, SK Telecom, Telefónica, Travelocity, Via, and many others. The firms mentioned above belong to various industries including ad tech, technology, digital platforms, mobile apps, social media, retail, ecommerce, linear TV, streaming services, telecommunications, CPG, travel and hospitality, supply chain logistics, and financial services, among others. These consulting engagements and research collaborations have primarily been on realizing business value from internet marketing, digital marketing, digital platforms, ad tech, marketing technology or “mar tech,” social media, and data privacy-related matters. I have extensive experience in the ad tech industry through my academic collaborations and consulting work with buy-side and sell-side companies as well as intermediaries in various parts of the ad tech ecosystem, including firms with services in demand-side platforms (DSP), ad exchanges, identity resolution, retargeting, data stitching, data management platforms (DMP), customer data platforms, data analytics, ad measurement and verification, and ad fraud, among others. For numerous firms, I have either built or advised them on building data-driven statistical, machine learning, and econometric models to measure the return on investment (ROI) of their marketing and advertising campaigns and help with budget allocation. I have analyzed individual-level consumer data collected via cookies and other advanced tracking techniques to evaluate the effectiveness of various kinds of display advertising campaigns.

8. I have taught courses on social media, digital marketing, and business analytics at the undergraduate, MBA, Executive MBA, TRIUM MBA, Master of Science in Business Analytics (MSBA), Executive Education, and Ph.D. levels worldwide. Many of these courses involve taking a deep dive into digital marketing, social media, data privacy, digital platforms, programmatic advertising, and various other aspects of the ad tech industry. By virtue of my multiple roles in the MSBA program at NYU Stern, starting from 2013 until now, I have supervised numerous ad tech focused Capstone projects at NYU in collaboration with advertisers, publishers and ad tech intermediaries in the industry. In 2019, I won the NYU Stern school-wide “Distinguished Teaching” award, the highest teaching honor at NYU Stern.

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9. I have also served as an expert witness for plaintiffs, government agencies, and defendants in litigation and have provided expert testimony in multiple trials and depositions.

10. I hold a Ph.D. and M.S. in Information Systems from Carnegie Mellon University, Tepper School of Business, and an MBA from the Indian Institute of Management, Calcutta. I also have an Instrumentation and Control Engineering degree from the National Institute of Technology in Jalandhar, India. A copy of my curriculum vitae and a list of my prior expert testimony are attached as **Appendix A**.

**B. Plaintiffs’ claims**

11. I understand that this matter is an action brought by 17 states and commonwealths<sup>4</sup> alleging that, for more than a decade, Defendant Google LLC has engaged in allegedly anticompetitive and deceptive conduct related to display advertising.<sup>5</sup>

12. Plaintiffs’ allegations include, among others, that Google “uses its interlocking web of monopolies to perpetuate a series of mutually reinforcing anticompetitive acts in complementary markets, all with a simple goal: further monopolization and greater monopoly profits.”<sup>6</sup> Plaintiffs further allege harm caused by Google’s alleged anticompetitive and deceptive conduct to publishers, advertisers, and others.<sup>7</sup>

13. Plaintiffs’ expert Professor Gans claims that “open web” display advertising is a “distinct type of online advertising appearing on content providers’ or publishers’ websites to reach a target user or audience,”<sup>8</sup> and he defines the relevant antitrust product markets to be “(1) the market for publisher ad servers used for the sale of open web display advertising inventory, (2) the market for ad exchanges for transacting indirect open web display advertising, (3) the market for ad buying tools for small advertisers for buying open web display advertising space and, (4)

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<sup>4</sup> Plaintiffs include the States of Texas, Alaska, Arkansas, Florida, Idaho, Indiana, Louisiana, Mississippi, Missouri, Montana, Nevada, North Dakota, South Carolina, South Dakota, and Utah, and the Commonwealths of Kentucky and Puerto Rico. *See* Fourth Amended Complaint, *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, May 5, 2023 (“Complaint”), ¶ 1.

<sup>5</sup> Complaint, ¶¶ 7-8, 526.

<sup>6</sup> Complaint, ¶ 7.

<sup>7</sup> *See, e.g.*, Complaint, ¶¶ 29, 532, 561.

<sup>8</sup> Expert Report of Joshua Gans, PhD, *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, June 7, 2024 (“Gans Report”), ¶ 79.

the market for ad buying tools for large advertisers.”<sup>9</sup> Dr. Chandler accepts Professor Gans’s definitions of the relevant markets<sup>10</sup> and opines that “Google is recognized in display advertising and the ad tech industry as the predominant player in publisher ad servers, ad exchanges, and ad-buying tools,” among other claims.<sup>11</sup>

### **C. Assignment**

14. I have been asked by counsel for Google to apply my academic and industry background and expertise in digital marketing to provide context for Plaintiffs’ allegations regarding digital advertising options for advertisers and publishers, providers of ad tech, and notable developments in ad tech over time. I have also been asked to respond to certain allegations in the Complaint and of Plaintiffs’ experts. In carrying out my assignment, I have reviewed available evidence and literature. I have not attempted to evaluate every claim made by Plaintiffs; claims not explicitly addressed should not be construed to imply that I agree with those claims. A list of the materials I have relied upon in this matter is provided as **Appendix B**.

15. My work on this matter is ongoing, and I reserve the right to update my opinions as additional information becomes available.

16. I am being compensated for my work in this matter at my current hourly rate of \$1,325. Professional staff members at Compass Lexecon performed support work for me under my direction. I also receive compensation based on a proportion of Compass Lexecon staff billings. Neither my fees nor those of Compass Lexecon are contingent upon the conclusions I reach or on the outcome of this matter.

## **II. SUMMARY OF OPINIONS**

17. Relying on the available market evidence, Plaintiffs’ expert reports, and documents, data and deposition testimony that are referenced in this report, I have reached the following conclusions.

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<sup>9</sup> Gans Report, ¶ 13.

<sup>10</sup> Expert Report of John Chandler, PhD, *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, June 7, 2024 (“Chandler Report”), Sections VII.C-E.

<sup>11</sup> Chandler Report, ¶ 194.

18. Plaintiffs and their experts rely on an artificially narrow concept of “open web display advertising” in their analyses. Professor Gans and Dr. Chandler exclude from their definition of “open web display advertising” certain display formats (*e.g.*, instream video ads) and properties (*e.g.*, social media, retailer platforms, connected television (known as CTV) platforms using integrated advertising tools, and mobile apps). As I discuss in **Section III**, this narrow delineation ignores reality and is inconsistent with the numerous interchangeable display advertising formats, properties, and devices available to advertisers in seeking to reach their desired audiences. Advertisers connect with publishers and reach users not only through the narrow slice of display advertising that Plaintiffs’ experts define as “open web display advertising,” but also through formats, properties, and devices that Plaintiffs and their experts disregard.

- Advertisers use display advertising for a variety of purposes, including creating brand awareness, developing consumer interest and desire, and driving sales. While Dr. Chandler recognizes the versatility of display advertising, he and Professor Gans artificially distinguish it from other forms of digital advertising that can be used for one or more of these very same functions.
- It is artificial and outdated to claim that users of “open web” are distinct from users of mobile apps, social media, retailer platforms, or CTV properties. There has been significant convergence between users of social media with users of the so-called “open web.” In addition, it is inconsistent to state that there are significant differences between users of the mobile web, which is within the Plaintiff’s concept of “open web display,” and users of mobile apps, which are excluded.
- While Dr. Chandler claims that different targeting capabilities distinguish open web from other types of advertising, Plaintiffs’ experts ignore that “open web display” and social media advertising, retailer advertising, and CTV advertising have many similar targeting options, and that targeting data from social media or retail sites like Meta or Amazon can be used to purchase ads on third-party web and app properties.
- Advertisers switch between *display formats* that the Plaintiffs and their experts include within their narrow concept of “open web display” (*e.g.*, text, image, and certain video ads) and other formats that they appear to exclude (such as instream video formats). In

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my academic work, I have previously categorized instream video ads as display ads, which aligns with the eMarketer data produced in this matter. And although Plaintiffs do not specifically include or exclude native ads from their analysis, native ads—like instream video ads—are used interchangeably with display ads and compete for budget against formats included within Plaintiffs’ and their experts’ definition of “open web display ads.”

- Advertisers buy display advertising across a range of *properties* including mobile apps, social media properties, retailer platforms, and CTV platforms. Advertisers see these as alternatives to the Plaintiffs’ concept of “open web display advertising,” despite the Plaintiffs’ arguments that advertising on in-house advertising tools or on apps is “distinct.” The distinctions that Professor Gans and Dr. Chandler draw between “open web display advertising” and advertising on apps, social media, retailer properties, and CTV misrepresent how advertisers use these properties interchangeably to reach their desired audiences.
- While Plaintiffs’ experts claim that small advertisers cannot access direct deals with publishers, in fact both advertisers and publishers can and do substitute between direct and indirect ad purchases.

19. Plaintiffs and their experts paint a static and outdated picture of how advertisers allocate their advertising budgets which is inconsistent with my experience and the evidence in this case. Plaintiffs and their experts fail to recognize how improvements in measurement in advertising have promoted the fluidity of advertisers’ spending across different formats, devices and properties. As I explain in **Section IV**, advertisers measure the effectiveness of their ad spending to reallocate budgets to maximize their return on investment. This fluidity in ad budgets is inconsistent with the Plaintiffs’ experts’ narrowly drawn concept of “open web display advertising.”

- Although Plaintiffs’ experts recognize the importance of measurement in digital advertising, they ignore how advertisers have been able to leverage improved measurement tools to allocate their budgets and ad placements across many different ad formats, devices, and properties more dynamically and fluidly. Advertisers have gained access to sophisticated measurement capabilities and increasingly have been able to

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measure the effectiveness of different types of display ads across different formats, devices, and properties.

- More specifically, advertisers have leveraged increased access to granular data, combined with statistical models and methods to measure the return on their advertising spending and to reallocate their campaign budgets to maximize their return on investment dynamically. Failing to account for the evidence of these commercial realities, Professor Gans and Dr. Chandler miss the fluidity of advertising spending between various different formats and properties and overstate differences between so-called “open web display advertising” and other types of display advertising.

20. Notwithstanding Dr. Chandler’s contention that Google did not disclose certain optimizations and experiments, Google has disclosed that it optimizes and experiments to better serve its customers. As I discuss in **Section V**, such optimizations and experiments are prevalent and well-known in the industry and industry participants expect them. More detailed disclosures of proprietary optimizations are unlikely to have made a meaningful difference: Advertisers typically delegate their bidding strategy to ad agencies, whose industry experience and technical sophistication reduce the need for detailed disclosures of auction mechanics by ad tech providers. The same is true for many publishers, who optimize their yield using the optimizations offered by ad tech providers and testing for the best results, rather than based on a detailed understanding of its ad tech providers’ algorithms.

21. Despite acknowledging that publishers, advertisers, and ad tech companies have access to many sources for data that can rival Google’s, Plaintiffs’ experts wrongly claim that Google’s scale of user data is a barrier to entry. As I discuss in **Section VI**, evidence shows that access to user data is not a substantial barrier to entry. Plaintiffs’ experts also wrongly suggest that Google’s plan to deprecate third-party cookies will undercut its rivals; Google has recently announced that it will not be deprecating third-party cookies.

- There are many competitors in display advertising that have access to large-scale first-party user data to target ads, including Meta, TikTok, X (formerly Twitter), Amazon, Walmart, Disney, Roku, and Netflix. Many internet users multi-home on digital platforms, so these firms have access to user-level demographic and behavioral data that can be comparable on many dimensions to Google’s. Many of these firms also offer

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advertisers the ability to buy ad space on third-party publisher properties, often with targeting capabilities that leverage these companies' first-party data.

- Even ad tech companies that do not have owned-and-operated properties have strong targeting capabilities. For example, The Trade Desk (which has a \$46 billion market capitalization), leverages both first-party and third-party data, and Google's own documents describe it as having stronger targeting capabilities than Google's DV360.
- User data is non-rivalrous (meaning that Google's access to data does not necessarily reduce the availability of similar data) and available broadly to many advertisers, publishers, and ad tech companies through a variety of methods, including cookies and similar methods of user identification, data brokers, data management platforms, and other sources.
- Ad tech companies consistently find innovative ways to improve their access to data. For example, as part of the trend toward supply path optimization, several ad agencies have combined their data directly with sell-side ad tech tools, bypassing traditional ad buying tools—including Google and its data—altogether.
- Plaintiffs' experts overstate the significance of scale in data in part because they ignore academic research demonstrating that there are diminishing returns to scale in data (*i.e.*, incremental additions of data are increasingly less valuable), which means that companies with large amounts of user data do not necessarily possess meaningful competitive advantages over companies with relatively less, but still ample, user data. As an example, academics have used experiments to assess how the quantity of user data impacted the ability to predict sales through digital advertising and found that additional granular data only marginally improved ad measurement precision.
- While Plaintiffs' experts acknowledge that industry-wide changes to data protection and user privacy have created challenges for targeted advertising, they claim that Google's efforts to preserve consumer benefits from targeted advertising "undercut" other ad tech players. However, Google and other ad tech players have taken initiatives to enhance user privacy while preserving the ability to serve targeted advertisements to users. Further, Plaintiffs' misplaced claims ignore that Google was developing its plan to deprecate



third-party cookies under supervision of the UK Competition & Markets Authority, and that Google has since announced that it will not be implementing its cookie-deprecation plan.

22. Plaintiffs’ experts depict a selective and outdated image of display advertising technology and how it has evolved, which in my opinion leads them to incorrect conclusions that misconstrue Google’s conduct. A more complete description of how the ad tech industry has evolved over the past three decades (which I provide in **Section VII**) supplies the missing context needed to understand Google’s conduct and corrects the distorted picture painted by Plaintiffs and their experts. For example:

- Professor Gans tries to distinguish ad buying tools for small advertisers from those for large advertisers, but that distinction does not reflect reality. In my experience, “buying tools for small advertisers” is not a term used by industry participants. Indeed, many of the ad buying tools that Professor Gans defines as those for “small advertisers” are used by advertisers of all sizes and share characteristics with the tools he defines as those for “large advertisers.”
- Plaintiffs’ experts ignore key facts to create the false impression that Dynamic Allocation (known as DA) was a feature launched by DoubleClick (later acquired by Google) to disadvantage real-time bidding and header bidding competitors. This theory ignores the benefits that Dynamic Allocation created for publishers, as well as the fact that the so-called “last look” advantage that Google purportedly derived from Dynamic Allocation did not arise through design choices by Google, but rather from publishers’ decision to use header bidding in conjunction with Google’s pre-existing technology (which existed years before the introduction of real-time bidding or header bidding).
- While portraying header bidding as a technological advancement, Plaintiffs’ experts gloss over header bidding’s significant drawbacks, including latency, domain spoofing, increased risk of ad fraud, privacy issues, billing discrepancies, and self-competition. Some of these drawbacks impact not only advertisers and publishers, but internet users as well. By minimizing these drawbacks, Plaintiffs’ experts fail to recognize how Google’s Open Bidding addressed some of them, while providing publishers with another way to transact with advertisers.



- Plaintiffs’ experts fail to adequately acknowledge the increasing integration within the ad tech industry. While asserting that Google has conflicts of interest as a result of offering a range of ad tech products, Plaintiffs’ experts fail to acknowledge that many ad tech providers, including Criteo, Microsoft’s Xandr (formerly AppNexus), Amazon, Comcast, Nexxen, and Magnite, all have integrated functions *across* the sell-side and buy-side to better serve their customers. Moreover, competitors that traditionally have focused only on the buy-side or only on the sell-side have created optimization paths that bypass each other, such that they end up competing with one another. Further, publishers like The Washington Post and Vox Media have developed in-house ad tech tools to facilitate the sale of their ad inventory. All this integration has improved efficiency and transparency in the ad buying and selling process.

23. Due to their incomplete portrayal of the ad tech industry, and their exclusion of interchangeable types of display advertising technologies from their analysis, Plaintiffs’ experts fail to acknowledge several additional pathways available to match advertisers and publishers. As I discuss in **Section VIII**, there are many such pathways available, and Plaintiffs’ and their experts’ analysis fails to consider that variety. In particular, Plaintiffs’ experts do not consider important pathways such as direct deals and transactions running through self-service platforms. But advertisers and publishers can (and do) choose between one or several different pathways that are available to them. In addition, Plaintiffs and their experts ignore the ongoing industry innovations that have opened up an increasing number of alternative pathways for publishers and advertisers as they seek to optimize their supply paths.

### **III. PLAINTIFFS’ EXPERTS ARTIFICIALLY EXCLUDE IMPORTANT ADVERTISING FORMATS AND PROPERTIES THAT ALLOW ADVERTISERS TO REACH THEIR DESIRED AUDIENCES.**

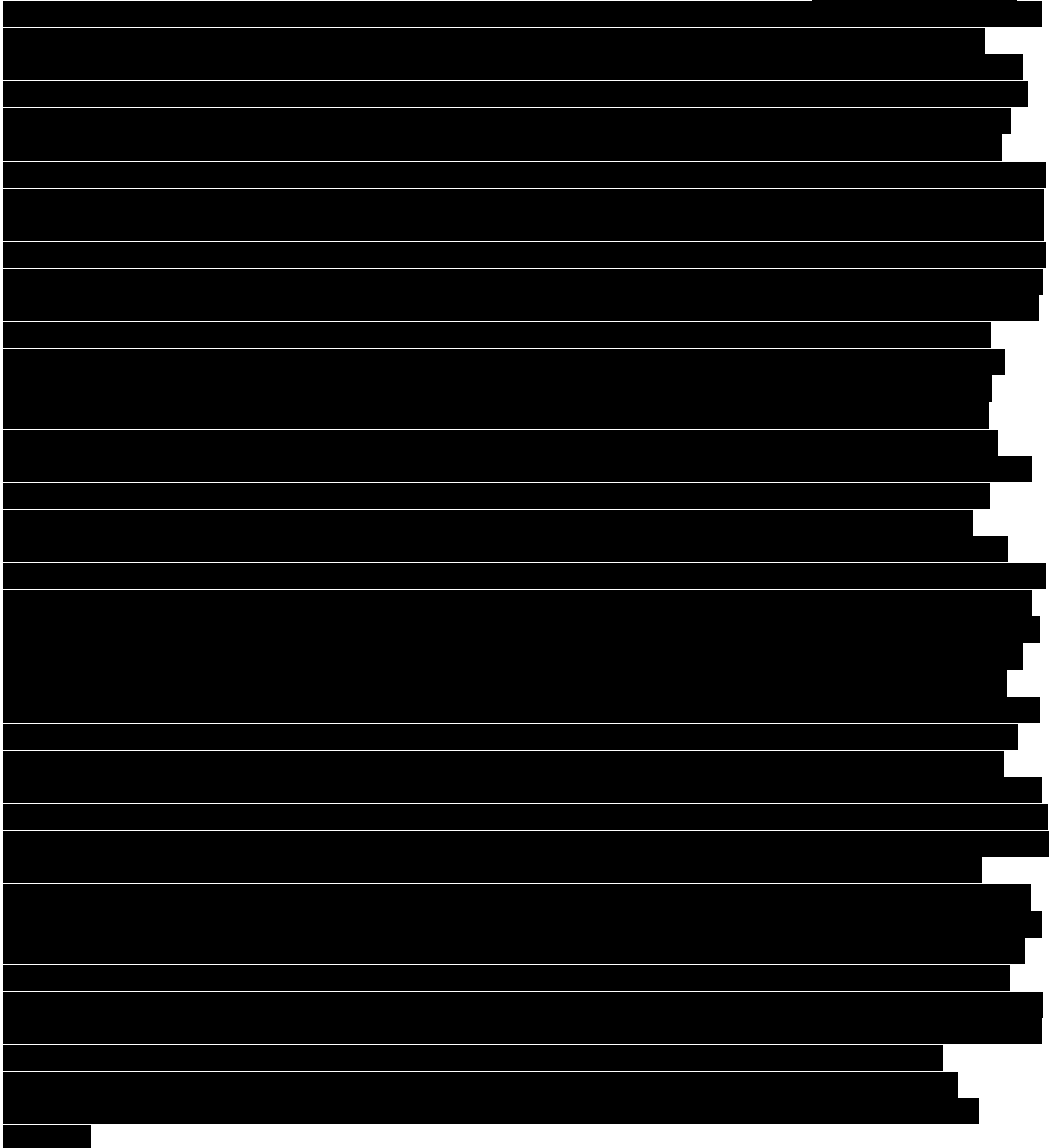
24. Display advertising refers to advertising that is displayed alongside digital media content other than search results. Display advertising is typically understood to include “banners, rich media, sponsorships, video, and ads such as Facebook’s News Feed Ads and Twitter’s Promoted Tweets” that appear “on desktop and laptop computers as well as mobile phones, tablets, and

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other internet-connected devices.”<sup>12</sup> **Figure 1** shows that ad spending on display ads has grown dramatically since 2008, especially since the advancement of mobile in the 2010s, to reach more than \$150 billion in spending in 2023.

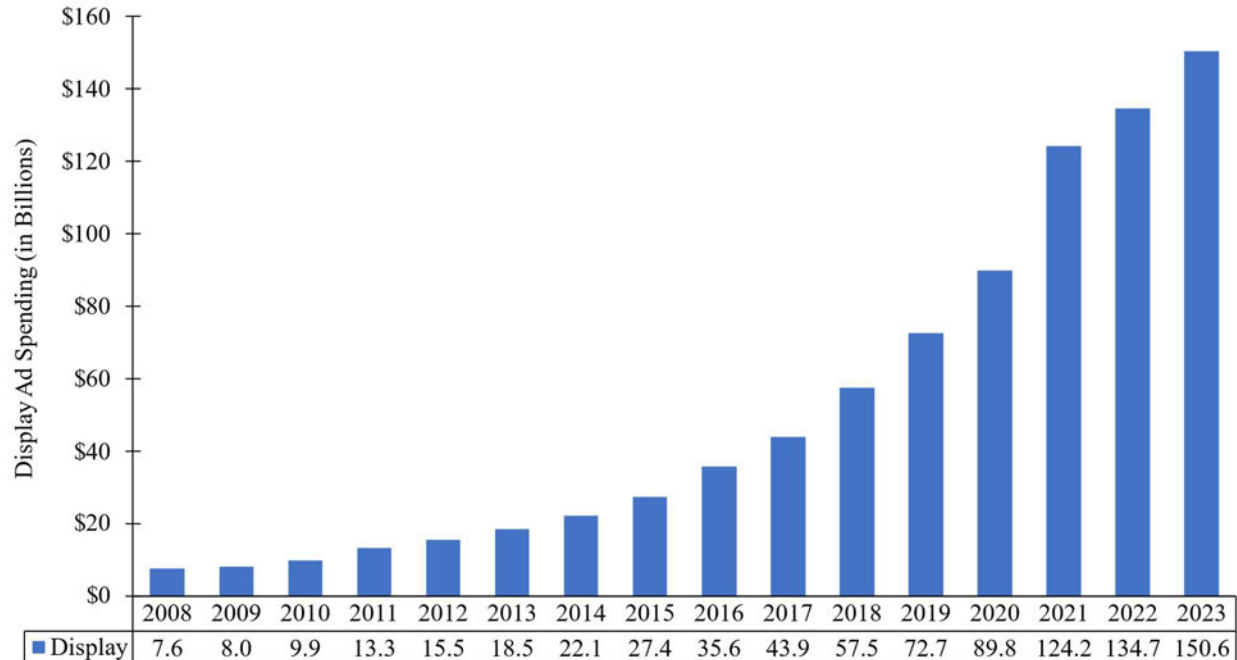
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<sup>12</sup> GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics,” Row 66); *see also* [REDACTED]



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**Figure 1. Display Ad Spending in the U.S., 2008-2023**



**Notes:**

[1] According to eMarketer, the ad spending presented above includes all formats of display ads (including banners, rich media, sponsorships, video, and ads such as Facebook’s News Feed Ads and X’s Promoted Posts) that appear on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

25. Plaintiffs’ experts Professor Gans and Dr. Chandler create an artificial distinction between what they call “open web display advertising”<sup>13</sup> and other online display advertising, and thereby exclude from their analysis many types of display advertising that are interchangeable.<sup>14</sup> “Interchangeable” or “interchangeability” is a term commonly used by ad tech

<sup>13</sup> To the extent I use the term “open web” in this report, I am engaging with Plaintiffs’ arguments and not indicating my agreement that “open web,” as Plaintiffs use it, is an accurate descriptor of a subset of display advertising.

<sup>14</sup> Gans Report, ¶ 79 (“Open web display ads are a distinct type of online advertising appearing on content providers’ or publishers’ websites to reach a target user or audience.”); Chandler Report, ¶ 42 (“Digital marketing is structured into marketing channels, which are used by advertisers in distinct and differentiated ways. Open web display advertising has unique characteristics and serves different purposes or goals for advertisers than other marketing channels.”).

industry practitioners to indicate substitutability between different display ad formats.<sup>15</sup> Plaintiffs’ experts exclude from their concept of “open web display advertising”: (i) formats such as instream video advertising,<sup>16</sup> (ii) properties such as social media properties (also discussed by Plaintiffs’ experts as “walled gardens”<sup>17</sup>), retailer properties, connected TV platforms, and advertising on mobile apps,<sup>18</sup> and (iii) display ads purchased via direct sales.<sup>19</sup> Based on my expertise and the record in this matter, this narrow focus on what Plaintiffs call “open web display advertising” is inconsistent with how advertisers and publishers buy and sell display advertising and allows Plaintiffs’ experts to artificially exclude numerous other interchangeable options available to and used by advertisers. In this section, I explain how, although Plaintiffs exclude many of them from their focus, advertisers use various formats and properties for similar purposes—namely, to reach their desired audiences—and can choose between direct or indirect sales methods. In addition, as I will explain further in **Section IV**, improvements in measurement have better enabled advertisers to reallocate funds across these display ad formats and properties

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<sup>15</sup> See, e.g., [REDACTED]

<sup>16</sup> Gans Report, ¶¶ 241, 255-260.

<sup>17</sup> Gans Report, ¶ 168 (“WGP’s (e.g., Facebook, Snapchat, Amazon, etc.) typically built their own in-house tools to sell ‘directly to the advertisers.’”). Owned-and-operated properties are those that sell their own display ad inventory to advertisers using their own integrated ad tech tools.

<sup>18</sup> Gans Report, Section III.B.2; Chandler Report, Sections V.A, V.B, and V.C. However, Professor Gans appears to include Meta Audience Network (formerly Facebook Audience Network) and Amazon DSP in his concept of “open web display advertising.” Gans Report, ¶ 141, Footnote 113, ¶ 273, Footnote 290.

<sup>19</sup> Gans Report, IV.D.3 (“Direct transactions are not in the relevant product market for indirect open web display advertising ad exchange”), ¶ 238.

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on a continuous basis to achieve their campaign goals and a better return on investment (known as ROI).

26. In order to explain the deficiencies in Plaintiffs' experts' view of the market, I will first provide a basic example of how display advertising works. Imagine that a user ("John Doe") visits the allrecipes.com website on his computer browser. The browser initiates a call to allrecipes.com's web server,<sup>20</sup> which loads the browser with articles. Simultaneously, the browser makes ad calls (also known as ad requests)<sup>21</sup> to one or more ad tech tools<sup>22</sup> used by allrecipes.com to sell the opportunities available on that website to show John an ad at that time.<sup>23</sup> As part of the ad call, the browser passes information about the particular place on the webpage where an advertisement could be seen (known as an "ad slot"<sup>24</sup>). **Figure 2** illustrates how ad slots appear on a webpage. Certain information about the user (browser and device) can be passed on by cookies, for example, which are small packets of data that website publishers and others transfer to users' web browsers when users visit websites.<sup>25</sup>

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<sup>20</sup> See, e.g., "What Is High Availability?" *F5*, available at <https://www.f5.com/glossary/web-server> ("[a] web server stores and delivers the content for a website – such as text, images, video, and application data – to clients that request it").

<sup>21</sup> See, e.g., "Ad call," *Clearcode*, available at <https://clearcode.cc/glossary/ad-call/>; "Ad request," *Google AdSense Help*, available at <https://support.google.com/adsense/answer/1082460?hl=en>.

<sup>22</sup> Ad tech is an umbrella term for the technologies that help match publishers looking to sell ad space on their properties ("inventory") with the advertisers looking to show ads to the users viewing those publishers' content.

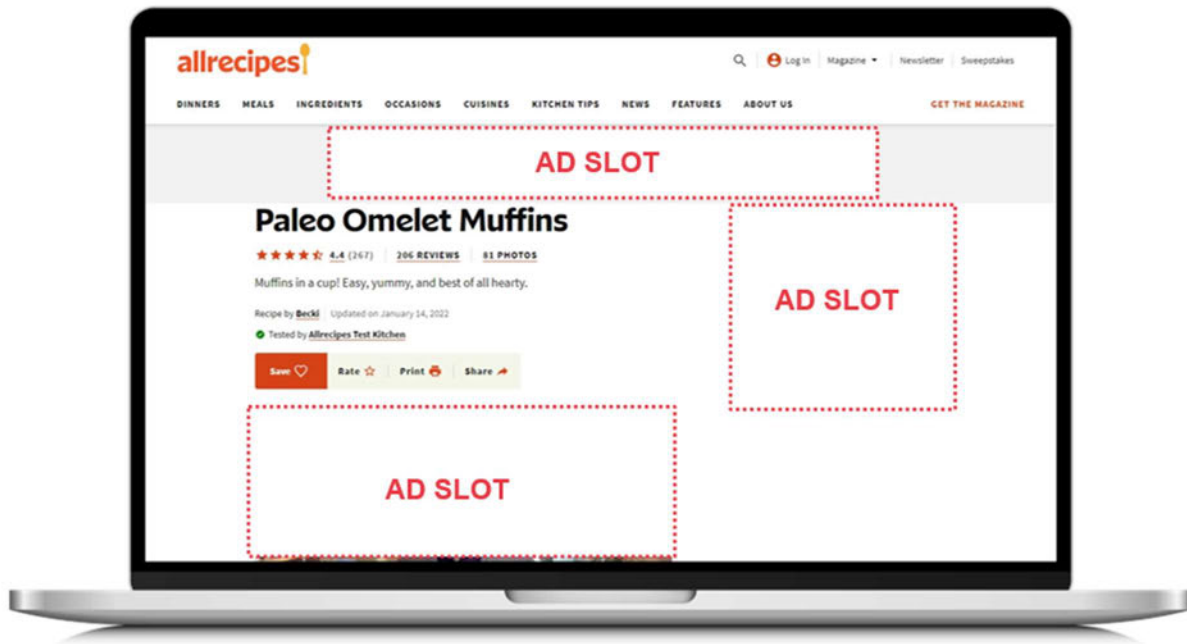
<sup>23</sup> See, e.g., "Jargon Glossary," *Publift*, available at <https://www.publift.com/programmatic-glossary> (a publisher ad server is a "digital store of content" that uploads ads to webpages and apps and targets ads to specific users).

<sup>24</sup> See, e.g., "Ad slot," *Clearcode*, available at <https://clearcode.cc/glossary/ad-slot-definition/>.

<sup>25</sup> See, e.g., "Cookie: Definition," *Google Ads Help*, available at <https://support.google.com/google-ads/answer/2407785?hl=en> ("A small file saved on people's computers to help store preferences and other information that's used on webpages that they visit.").

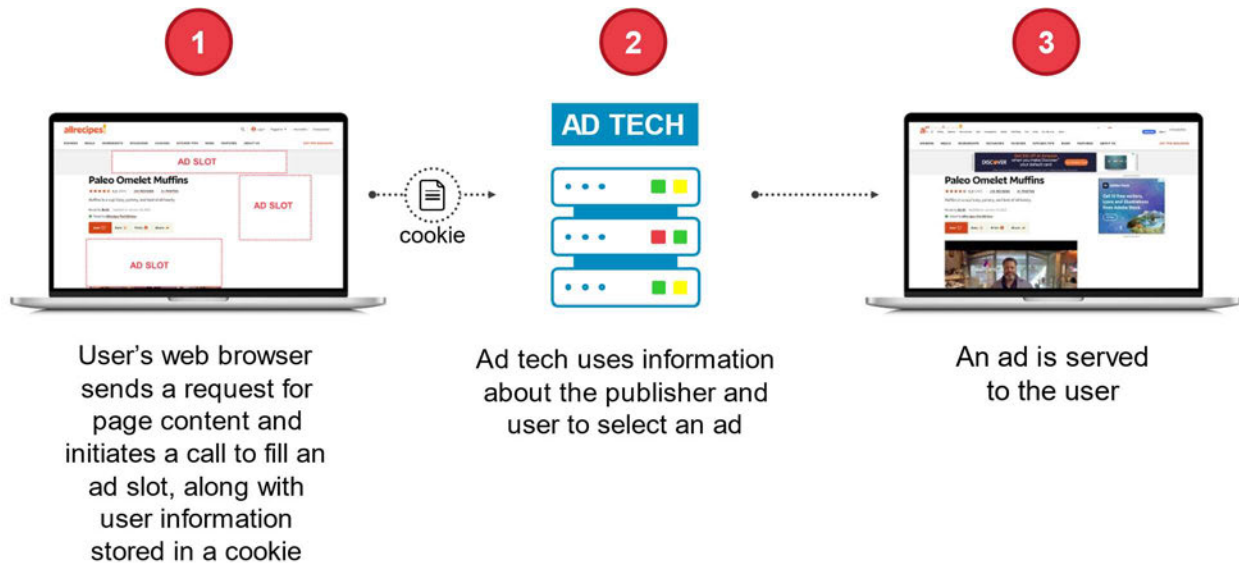
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**Figure 2. Illustration of Ad Slots**



27. The ad tech tools then virtually instantaneously select an ad to show (“serve”) to John when the allrecipes.com website has loaded in the browser. **Figure 3** provides a high-level illustration of the ad serving process. In **Section VII**, I describe how ad tech tools have evolved over time to better match ads with available inventory.

**Figure 3. Illustration of the Ad Serving Process**



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28. Professor Gans claims that social media advertising, in-app advertising, and instream advertising “are non-substitutable to display ads for advertisers, given they serve different purposes even when a brand’s potential customers see different types of ads,”<sup>26</sup> and Dr. Chandler claims that “[o]pen web display advertising has unique characteristics and serves different purposes or goals for advertisers than other marketing channels.”<sup>27</sup> Dr. Chandler further contends that “[a]cademic studies consistently categorize and analyze search, social media, and video advertising independently of display advertising” without referencing any academic literature.<sup>28</sup> Contrary to his claim, there are academic studies published in peer-reviewed journals that analyze the market strategies of advertising campaigns containing a combination of the advertising channels mentioned above.<sup>29</sup>

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<sup>26</sup> Gans Report, ¶ 77.

<sup>27</sup> Chandler Report, ¶ 42.

<sup>28</sup> Chandler Report, ¶ 84.

<sup>29</sup> See, e.g., Guillaume Hervet, and Ivan A. Guitart, “Increasing the effectiveness of display social media ads for startups: The role of different claims and executional characteristics,” *Journal of Business Research*, Vol. 153, 2022, pp. 467-478 at p. 469 (“Owned social media efforts include tactics such as posts on brand pages or brand-related tweets, whereas paid efforts include tactics such as display and video ads.”); Liguu Lou, and Joon Koh, “Social Media Advertising Effectiveness: A Conceptual Framework and Empirical Validation,” *Asia Pacific Journal of Information Systems*, Vol. 28, No. 3, 2018, pp. 183-203 at p. 190 (“[D]isplay advertisements on Facebook mainly comprise four different kinds of advertisements (i.e., banner advertisements, rich media advertisements, video advertisements, and sponsorships)[.]”); Edward C. Malthouse, Ewa Maslowska, and Judy U. Franks, “Understanding programmatic TV advertising,” *International Journal of Advertising*, Vol. 35, No. 5, 2018, pp. 769-784 at p. 775 (“[I]f a customer visits a retailer’s website and studies a certain product, the retailer can currently buy display ads on other websites (e.g. news sites) showing that product to the consumer[.]”); Hana Choi, Carl F. Mela, Santiago R. Balseiro, and Adam Leary, “Online Display Advertising Markets: A Literature Review and Future Directions,” *Information Systems Research*, Vol. 31, No. 2, 2020, pp. 556-575 at pp. 568-569 (discussing “mobile display advertising” and “social media display” advertising); Sumitra Auschaitrakul, and Ashesh Mukherjee, “Online Display Advertising: The Influence of Web Site Type on Advertising Effectiveness,” *Psychology & Marketing*, Vol. 34, No. 4, 2017, pp. 463-480 at p. 463 (acknowledging “the frequent use of [online display advertising] on social networking Web sites”); Vahideh Sadat Abedi, “Allocation of advertising budget between multiple channels to support sales in multiple markets,” *Journal of the Operational Research Society*, Vol. 68, No. 2, 2017, pp. 134-146 at p. 134 (“Therefore, a mix of marketing channels is typically utilized that differ from each other in their level of targetability, effectiveness, and cost.”). Additionally, academic researchers have recognized the importance of omnichannel marketing, a marketing method of interacting with consumers in many touchpoints, including on websites and on social media. See Peter C. Verhoef, P.K. Kannan, and J. Jeffrey Inman, “From Multi-Channel Retailing to Omni-Channel Retailing Introduction to the Special Issue on Multi-Channel Retailing,” *Journal of Retailing*, Vol. 91, No. 2, 2015, pp. 174-181 at p. 179 (“Research on channels and performance should definitely move more to omni-channel issues.”); Katherine N. Lemon, and Peter C. Verhoef, “Understanding Customer Experience Throughout the Customer Journey,” *Journal of Marketing*, Vol. 80, No. 6, 2016, pp. 69-96 at p. 69 (acknowledging that customers “interact with firms through myriad touch points in multiple channels and media,” and that “omnichannel management has become the new norm”).

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29. Plaintiffs’ experts attempt to differentiate “open web display advertising” from social media, in-app, and video advertising based on the ad’s function, audience, targeting capabilities, location, and pricing, but they are incorrect on each front.<sup>30</sup>

30. **Function.** Professor Gans and Dr. Chandler use the “marketing funnel” to distinguish display advertising from social and in-app advertising based on their function.<sup>31</sup> The traditional “marketing funnel” model describes stages from the top to the bottom of the funnel, such as attention, interest, desire, and action (also known as the AIDA framework). Plaintiffs’ experts claim that “open web” display advertising is typically used to generate brand or product awareness,<sup>32</sup> whereas social media advertising generates desire,<sup>33</sup> and in-app advertising is used to “drive engagement.”<sup>34</sup> However, Plaintiffs’ experts themselves acknowledge the broader application of “open web” display advertising for many different marketing objectives along the full length of the funnel. Dr. Chandler states, “[t]he display channel is notable because it can be used at all stages of the funnel,”<sup>35</sup> and concedes that different formats of display advertising are “well-suited,” “useful,” and “highly effective” in at least three of the AIDA stages—awareness, interest, and action.<sup>36</sup> And Professor Gans notes, “[a]dvertisers also use display advertising to drive conversions,”<sup>37</sup> a traditionally lower-funnel function. I agree: Research has shown that digital display ads contribute to multiple objectives at different stages in the consumers’

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<sup>30</sup> Chandler Report, ¶¶ 42, 58-78, Section V.C; Gans Report, ¶¶ 79-92.

<sup>31</sup> Chandler Report, ¶ 34 (“In general, the funnel helps convey and distinguish key practices in advertising campaigns and how they look in both traditional and digital media.”); Gans Report, ¶ 74 (“Each type of advertising enables distinct targeting of potential users. Advertisers seek inventory that best aligns their campaign goals with their campaign budget. Advertisers choose a specific ad type or types to match the goal of a particular ad campaign. Each ad type fulfils [*sic*] distinct campaign goals and takes place at different stages of the marketing funnel.”), ¶ 76 (“Many advertisers use the marketing funnel to understand their customers and plan their marketing campaigns. An advertiser might launch simultaneous campaigns to reach distinct customers at the various stages of the marketing funnel.”).

<sup>32</sup> Gans Report, ¶ 80 (“Advertisers use display advertising to drive brand awareness.”); Chandler Report, ¶ 44 (“[...] [T]raditional display is typically used for brand awareness [...]”).

<sup>33</sup> Chandler Report, ¶ 37.

<sup>34</sup> Chandler Report, ¶ 76 (quotations omitted).

<sup>35</sup> Chandler Report, ¶ 46.

<sup>36</sup> Chandler Report, ¶¶ 35-36, 38.

<sup>37</sup> Gans Report, ¶ 82.



purchase process, including increasing active searches and passive searches<sup>38</sup> along with brand awareness, conversions, and sales.<sup>39</sup> The fact that display advertising can be and is used at multiple stages of the funnel means that display ads face competition from other types of advertising at each of those stages.

31. Moreover, the concept of the traditional marketing funnel itself is outdated and understates the fluidity of advertisers' spending.<sup>40</sup> The emergence of digital advertising has altered consumers' paths to purchase journey: from what was considered a linear, sequential process to one that now is not sequential for all products or customers. Rather than systematically advancing from one stage to the next in a fixed sequential format, consumers can revisit the same stages in an iterative and non-sequential manner or bypass certain stages while moving toward a purchase.<sup>41</sup> Dr. Chandler recognizes that "[c]ustomers do not necessarily move through all the stages of the advertising funnel in a linear or sequential way, and the funnel has evolved considerably since its original formulation to adapt to different kinds of markets and

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<sup>38</sup> Anindya Ghose, and Vilma Todri-Adamopoulos, "Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior," *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910 at p. 890.

<sup>39</sup> Research by Johnson et al. (2017), consisting of an exhaustive meta-analysis of 432 field experiments, endorses the effectiveness of display advertisements for customer actions undertaken closer to the point of purchase. *See* Garrett Johnson, Randall A. Lewis, and Elmar Nubbemeyer, "The Online Display Ad Effectiveness Funnel & Carryover: Lessons from 432 Field Experiments," *SSRN*, 2017, available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2701578](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2701578); A study by Gordon et al. (2022) scrutinized 663 large-scale experiments and discovered that Facebook display and video advertisements augmented conversion for users exposed to ads at upper, middle, and lower stages of the purchase funnel. *See* Brett R. Gordon, Robert Moakler, and Florian Zettelmeyer, "Close Enough? A Large-Scale Exploration of Non-Experimental Approaches to Advertising Measurement," *Marketing Science Institute Working Paper Series*, Report No. 22-106, 2022, pp. 1-39, available at [https://www.msi.org/wp-content/uploads/2022/03/MSI\\_Report\\_22-106.pdf](https://www.msi.org/wp-content/uploads/2022/03/MSI_Report_22-106.pdf). Similarly, Meta describes different settings that can be used by advertisers to meet different campaign objectives across the different stages in the purchase journey. *See, e.g.*, "How to choose the right ad objective in Meta Ads Manager," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/1438417719786914>.

<sup>40</sup> Tom Roach, "Why the sales funnel is the cockroach of marketing concepts," *Marketing Week*, September 1, 2021, available at <https://www.marketingweek.com/sales-funnel-100-years/>.

<sup>41</sup> Vilma Todri, Anindya Ghose, and Param Vir Singh, "Trade-Offs in Online Advertising: Advertising Effectiveness and Annoyance Dynamics Across the Purchase Funnel," *Information Systems Research*, Vol. 31, No. 1, 2020, pp. 102-125; Chenshuo Sun, Panagiotis Adamopoulos, Anindya Ghose, and Xueming Luo, "Predicting Stages in Omnichannel Path to Purchase: A Deep Learning Model," *Information Systems Research*, Vol. 33, No. 2, 2022, pp. 429-445 at p. 431 ("In the past, because of lack of granular and precise data and limitations in measurement of ad effectiveness advertisers used the traditional AIDA marketing framework. However, it is important to acknowledge that things have dramatically changed in recent years with the digital transformation of marketing and advertising and that the path to purchase journey is not necessarily fixed or sequential for consumers.").

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consumers,” but his further discussion of the funnel fails to reflect his recognition of this significant feature of the consumer path to purchase journey.<sup>42</sup> And while Professor Gans purports to define the “market” using the marketing funnel solely based on a conversation with Dr. Chandler,<sup>43</sup> he does not acknowledge the fluidity that Dr. Chandler recognizes, nor that display ads have a role throughout the funnel.<sup>44</sup>

32. Recognizing this more complex understanding of consumer behavior, some experts have proposed a newer model called the “consumer decision journey.”<sup>45</sup> This framework acknowledges that consumers interact with numerous touchpoints, including various forms of advertising, and the combined impact of these touchpoints shapes the consumers’ intent to purchase. These touchpoints can take place prior to, amid, or following a purchase. Unlike the funnel model (which suggests a linear sequence of stages), a consumer’s purchase process does not always progress in the same step-by-step manner. Rather, a consumer’s engagement with a company evolves over time through multiple touchpoints.<sup>46</sup> Practitioners have also moved on to newer models that reflect actual consumer behavior beyond the outdated traditional marketing funnel<sup>47</sup> and reflect the non-linear consumer path to purchase journey.<sup>48</sup>

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<sup>42</sup> Chandler Report, ¶ 34.

<sup>43</sup> Gans Report, Footnote 35.

<sup>44</sup> Gans Report, ¶¶ 75-92.

<sup>45</sup> David Court, Dave Elzinga, Susan Mulder, and Ole Jørgen Vetvik, “The consumer decision journey,” *McKinsey & Company*, June 1, 2009, available at <https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/the-consumer-decision-journey>, at pp. 1-11.

<sup>46</sup> Katherine N. Lemon, and Peter C. Verhoef, “Understanding Customer Experience Throughout the Customer Journey,” *Journal of Marketing*, Vol. 80, No. 6, 2016, pp. 69-96.

<sup>47</sup> “The Future Shopper: How Changing Shopper Attitudes and Technology are Reshaping Retail,” *The Futures Company & Kantar Retail*, 2013, available at [https://wppstream.com/wpp/marketing/consumerinsights/~/\\_media/Reading-Room/Consumer-Insights/future\\_perspective\\_the\\_future\\_shopper\\_mar13.pdf](https://wppstream.com/wpp/marketing/consumerinsights/~/_media/Reading-Room/Consumer-Insights/future_perspective_the_future_shopper_mar13.pdf), at p. 3 (“While [the path to purchase described by the purchase funnel] probably was never that simple, at least outside of the Marketing 101 textbooks, it is certainly not true now. The purchase funnel has become a ‘purchase fish,’ a complex world of feedback involving research, multi-channel contact with the seller and eventual purchase, as well as the testing of opinion with an ever-larger group of other consumers.”).

<sup>48</sup> Jacqueline Dooley, “Marketing attribution: What it is, and how it identifies vital customer touchpoints,” *MarTech*, April 5, 2022, available at <https://martech.org/marketing-attribution-what-it-is-and-how-it-identifies-vital-customer-touchpoints/> (“A dynamic marketing environment refers to the nonlinear characteristic of the modern customer journey. It speaks to how each piece of content, interaction, and experience contributes to the culmination of the buying journey (e.g., the sale, lead, or conversion).”).

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33. **Audience.** Dr. Chandler claims that “open web display advertising” is distinct from advertising on social media, instream video, and apps because they reach different audiences.<sup>49</sup> But the populations of “open web” and social media users have largely converged over time: as of April 2024, 93% (= 5.07 billion / 5.44 billion) of worldwide internet users were social media users.<sup>50</sup> Likewise, the populations of “open web” and app users do not appear to be as distinct as Dr. Chandler claims: according to a 2022 Gallup survey of 30,000 U.S. adults, 97% of respondents reported owning a smartphone, which is the device on which mobile apps are used.<sup>51</sup> There is also a large overlap between users of video apps and social media platforms; for example, 98.7% of YouTube users also use one or more social media platforms, including Facebook, Instagram, TikTok, and other platforms.<sup>52</sup> The direct overlap of the populations negates Dr. Chandler’s claim that advertising on social media, mobile apps, and digital video reach “different types of audiences.”<sup>53</sup>

34. **Targeting.** Dr. Chandler and Professor Gans claim that targeting on social media and app properties is “distinct” and “unique” compared to targeting available for “open web” display ads. For example, Dr. Chandler claims, “[t]he difference between social media advertising and these other channels is the use of the data that is unique to social media: the network connections between individuals,”<sup>54</sup> and “[t]he primary power of in-app advertising lies in its ability to

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<sup>49</sup> Chandler Report, ¶ 81 (“Other channels such as search advertising, social media, digital video, in-app advertising, and email marketing offer distinct approaches and advantages to reaching different types of audiences.”).

<sup>50</sup> Ani Petrosyan, “Worldwide digital population 2024,” *Statista*, May 22, 2024, available at <https://www.statista.com/statistics/617136/digital-population-worldwide/> (“As of April 2024, there were 5.44 billion internet users worldwide [...] Of this total, 5.07 billion [...] were social media users.”).

<sup>51</sup> Chandler Report, ¶ 74; Lydia Saad, “Americans Have Close but Wary Bond With Their Smartphone,” *Gallup*, June 20, 2022, available at <https://news.gallup.com/poll/393785/americans-close-wary-bond-smartphone.aspx>. Additionally, according to an online survey of 1,316 U.S. teenagers (ages 13 to 17) conducted in 2022, 95% reported having access to a smartphone. See Emily A. Vogels, Risa Gelles-Watnick, and Navid Massarat, “Teens, Social Media and Technology 2022,” *Pew Research Center*, August 10, 2022, available at <https://www.pewresearch.org/internet/2022/08/10/teens-social-media-and-technology-2022/>.

<sup>52</sup> “Social media user overlaps mapped,” *WARC*, January 29, 2021, available at <https://www.warc.com/newsandopinion/news/social-media-user-overlaps-mapped/en-gb/46624>.

<sup>53</sup> Chandler Report, ¶ 81 (“Other channels such as search advertising, social media, digital video, in-app advertising, and email marketing offer distinct approaches and advantages to reaching different types of audiences.”).

<sup>54</sup> Chandler Report, ¶ 58.

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leverage real-time data to optimize ad targeting.”<sup>55</sup> Professor Gans likewise claims social media advertising can “be targeted based on information that comes from a user’s social graph (*i.e.*, their friends, connections, follows and interactions with respect to content on those networks), which gives advertisers a distinct set of targeting opportunities available within the walled gardens of those networks.”<sup>56</sup> But in my opinion, this vastly overstates the differences in the kinds of targeting available to advertisers across these different properties. *First*, the “unique” data available to social media companies is not used solely to place social ads: Indeed, the advertising platforms offered by Meta and X use the data gleaned from their social media sites to target ads on other properties.<sup>57</sup> *Second*, the targeting data available to social media companies and in-app advertisers is not fundamentally different from what is available to advertisers using other tools.<sup>58</sup> Based on my experience, advertisers have many similar capabilities to target their desired audiences using “open web” display advertising as they do with social media, instream video, and app properties. Indeed, advertisers can deliver ads based on demographic, geographic, behavioral, contextual, psychographic, and remarketing targeting on social media, instream video, and app properties, as well as on the “open web.”<sup>59</sup> For example, as summarized in **Table**

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<sup>55</sup> Chandler Report, ¶ 76.

<sup>56</sup> Gans Report, ¶ 85.

<sup>57</sup> “Increase your reach on and off Twitter with the Twitter Audience Platform,” *X Blog*, August 20, 2015, available at [https://blog.x.com/en\\_us/a/2015/increase-your-reach-on-and-off-twitter-with-the-twitter-audience-platform](https://blog.x.com/en_us/a/2015/increase-your-reach-on-and-off-twitter-with-the-twitter-audience-platform); “X Audience Platform,” *X Help Center*, available at <https://help.x.com/en/x-audience-platform>; Alex Spencer, “Facebook Opens Up Audience Network Header Bidding,” *Sonobi*, March 30, 2017, available at <https://sonobi.com/press-release/facebook-opens-audience-network-header-bidding/>; “Changes to Web and In-Stream Placements,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/645132129564436> (From 2017 to 2020, Facebook Audience Network provided access to mobile web, instream and app ads; in 2020, Facebook transitioned to app ads.); *see also* Gans Report, Footnote 225 (“Until 2020, Meta offered ‘Facebook Audience Network’ (FAN), an ad tech tool that facilitated the purchase of open web display advertising. Today, Meta offers Meta Audience Network, a tool that focuses on the purchase of advertising on Meta own and operated properties and third-party mobile apps.”).

<sup>58</sup> As described in **Sections III.B.2** and **III.B.3**, social media and retail sites do have some unique data, which makes them especially strong competitors to Google.

<sup>59</sup> *See, e.g.*, “Audience ad targeting,” *Meta ads*, available at <https://www.facebook.com/business/ads/ad-targeting>; “About targeting for Display campaigns,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/2404191?hl=en>; “Reach your audience on apps and websites,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/2404239?hl=en>; “Location targeting,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/6317?hl=en>; “Contextual targeting,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/1726458?hl=en>; “Show your ads in mobile apps,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/1722057?hl=en>; Will Webster, “What is psychographic segmentation? A beginner’s guide,” *Qualtrics*, available at

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1 below, Google Ads provides advertisers looking to buy display ads on what plaintiffs refer to as the “open web” with the ability to target audiences based on a variety of demographic options (including “age range, gender, parental status, or household income,”<sup>60</sup> “device targeting,”<sup>61</sup> “[t]heir interests and habits, [w]hat they’re actively researching, [p]eople who’ve already interacted with your ads, website, or app and may return,”<sup>62</sup> “location targeting,”<sup>63</sup> “remarketing,”<sup>64</sup> among others. Meta provides advertisers with targeting options based on “[d]emographics like age, gender and location[, ...] [t]he mobile device they use and the speed of their network connection[, ...] [a]ds they click[, ...] [p]ages they engage with[, ...] [a]ctivities people engage in across Meta technologies related to things like their device usage, and travel preferences,”<sup>65</sup> “location targeting,”<sup>66</sup> “retargeting,”<sup>67</sup> among others. TikTok also provides targeting options based on demographics, device, interests and behaviors such as “based on the user’s recent in-app [b]ehavior such as interactions with videos or creators,”<sup>68</sup> location,<sup>69</sup> and

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<https://www.qualtrics.com/experience-management/brand/psychographic-segmentation/>; “About targeting for Video campaigns,” *YouTube Help*, available at <https://support.google.com/youtube/answer/2454017?hl=en>.

<sup>60</sup> See, e.g., “About demographic targeting,” *Google Ads Help*, available at [https://support.google.com/google-ads/answer/2580383?hl=en&ref\\_topic=10546255&sjid=1529768524477922630-NC](https://support.google.com/google-ads/answer/2580383?hl=en&ref_topic=10546255&sjid=1529768524477922630-NC).

<sup>61</sup> See, e.g., “About device targeting,” *Google Ads Help*, available at [https://support.google.com/google-ads/answer/1722028?hl=en&ref\\_topic=10544125&sjid=1529768524477922630-NC](https://support.google.com/google-ads/answer/1722028?hl=en&ref_topic=10544125&sjid=1529768524477922630-NC).

<sup>62</sup> See, e.g., “Targeting your ads,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/1704368?hl=en>.

<sup>63</sup> See, e.g., “Target ads to geographic locations,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/1722043?hl=en>.

<sup>64</sup> See, e.g., “About dynamic remarketing: show ads tailored to your site and app visitors,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/3124536?hl=en>.

<sup>65</sup> See, e.g., “About detailed targeting,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/182371508761821?id=176276233019487>.

<sup>66</sup> See, e.g., “About location targeting,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/202297959811696?id=176276233019487>.

<sup>67</sup> See, e.g., “Retargeting: Inspire people to rediscover what they love about your business.” *Meta*, available at <https://www.facebook.com/business/goals/retargeting>.

<sup>68</sup> “About Ad Targeting,” *TikTok: Business Help Center*, available at <https://ads.tiktok.com/help/article/ad-targeting?lang=en>.

<sup>69</sup> “About Ad Targeting,” *TikTok: Business Help Center*, available at <https://ads.tiktok.com/help/article/ad-targeting?lang=en>.

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retargeting.<sup>70</sup> Amazon<sup>71</sup> and X<sup>72</sup> likewise enable demographic and behavioral targeting, device targeting, location targeting, and remarketing, among others. *Third*, Professor Gans and Dr. Chandler ignore that users multi-home across digital platforms (*i.e.*, Instagram users also often use X or LinkedIn, and also see ads on the open web and on their mobile phones), which means that significant amounts of targeting data about those users is not solely available to one type of property versus another.

**Table 1. Examples of Targeting Options Provided by Some Ad Tech Platforms**

Ad Tech Platform	Selected Type of Targeting Options				
	Demographic Targeting	Device Targeting	Behavioral Targeting	Location Targeting	Remarketing Targeting
Google	✓	✓	✓	✓	✓
Meta	✓	✓	✓	✓	✓
TikTok	✓	✓	✓	✓	✓
Amazon	✓	✓	✓	✓	✓
X	✓	✓	✓	✓	✓

<sup>70</sup> “About App Retargeting,” *TikTok: Business Help Center*, available at <https://ads.tiktok.com/help/article/app-retargeting?lang=en>.

<sup>71</sup> Jessie Liu, “How behavioral and demographic audiences perform on Amazon,” *Amazon Ads*, available at <https://advertising.amazon.com/library/research/behavioral-and-demographic-audiences>; “Device ads,” *Amazon Ads*, available at <https://advertising.amazon.com/products/device-ads>; Michael Waters, “Is geo-targeting on Amazon worth it?” *Intentwise*, March 4, 2024, available at <https://www.intentwise.com/blog/amazon-dsp/is-geo-targeting-on-amazon-worth-it/>; “Guide to Sponsored Display views remarketing and lookback windows,” *Amazon Ads*, available at <https://advertising.amazon.com/library/guides/sponsored-display-purchases-remarketing>.

<sup>72</sup> “Twitter Ads Targeting,” *X Business*, available at <https://business.twitter.com/content/dam/business-twitter/targeting/twitter-ads-targeting.pdf>; “The beginner’s guide to Twitter ad targeting,” *Strike Social*, available at <https://strikesocial.com/blog/twitter-ad-targeting/>; “Remarketing on Twitter,” *WebFX*, available at <https://www.webfx.com/social-media/learn/remarketing-on-twitter/>.



35. **Location.** Dr. Chandler claims that for in-app and social media advertising, “the channel is defined more by where the ads are delivered than the format of the ad.”<sup>73</sup> This concession acknowledges that there is no meaningful difference between the formats of “open web display ads,” ads on social media, and ads viewed in apps. As discussed in this section and in **Section IV**, advertisers can and do substitute across these types of ads.

36. **Pricing.** The fact that different display ad formats can have different price points (i.e., higher vs. lower CPMs)<sup>74</sup> does not preclude advertisers from considering and using them as viable alternatives while they engage in budget allocation and reallocation. The extent of interchangeability and substitution is based on return on investment (ROI) or return on ad spend (ROAS).

37. As I discuss below, contrary to Dr. Chandler’s opinions, advertisers purchase display ads across different formats and properties and via both direct and indirect sales.

**A. Advertisers can substitute between a variety of ad formats that serve similar functions.**

38. Plaintiffs’ experts describe a variety of display ad formats, including text ads, image ads, outstream video ads, instream video ads, and native ads,<sup>75</sup> yet craft an “open web display advertising” definition that includes only some of these formats.

39. Professor Gans opines that Plaintiffs’ alleged open web display advertising markets include text ads, image ads, and some forms of video ads.<sup>76</sup> However, he is silent on whether the market includes native ads, and claims that instream video is excluded from the market.<sup>77</sup> In my experience, however, and based on the evidence in this matter discussed in **Section IV**,

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<sup>73</sup> Chandler Report, ¶ 76 (“In-app marketing shares a common trait with social media advertising—the channel is defined more by where the ads are delivered than the format of the ad.”).

<sup>74</sup> Chandler Report, ¶¶ 86-92.

<sup>75</sup> Gans Report, ¶ 47; Chandler Report, ¶¶ 27, 45.

<sup>76</sup> Gans Report, ¶ 47; Chandler Report, ¶ 27.

<sup>77</sup> Gans Report, ¶¶ 79, 136-137, 241, 255, Footnote 18; Errata to June 7, 2024 Expert Report of Joshua Gans, *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, July 24, 2024, ¶¶ 136-137, Footnote 18. Professor Chandler does not specifically address instream versus outstream video, but more generally opines that “video advertising is an advertising channel that is distinct from [...] display advertising” (see Chandler Report, ¶ 69), while elsewhere stating that “[d]isplay advertising is characterized by its use of visual and multimedia formats” (see Chandler Report, ¶ 45).

advertisers use native advertising and instream video ads interchangeably with the text ads, image ads, and outstream video that Plaintiffs’ experts include within their definition of “open web display advertising.” Their artificial segmentation is not consistent with market realities for advertisers and publishers.

40. The following display ad formats are often used for similar purposes:

- **Text ads:** These are display ads that convey their message on a product or service using only text.
- **Image ads:** These are display ads that convey their message using a combination of image and text (including both static and animated ads).
- **Outstream video ads:** These are a type of video ads<sup>78</sup> that convey their message using a video clip that appears *as a standalone advertisement next to other digital content*.<sup>79</sup>
- **Instream video ads:** These are another type of video ads that convey their message using a video clip that typically appears *within online video content*.<sup>80</sup> In my academic research, I have previously categorized instream videos as display ads, consistent with the

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<sup>78</sup> eMarketer defines “display ad spending” as including “banners, rich media, sponsorships, video, and ads such as Facebook’s News Feed Ads and X’s Promoted Posts.” eMarketer further defines “video ad spending” as including “**in-stream video** such as those appearing before, during, or after digital video content in a video player (pre-roll, mid-roll, or post-roll video ads) and video overlays,” “**social network in-stream video advertising** in platforms such as Facebook Watch and Snapchat Shows” and “**outstream video ads** such as native, in-feed (including video ads in Facebook’s News Feed and X’s Promoted Posts), in-article, in-banner, and interstitial video ads.” See GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics,” Rows 66, 70) (emphasis added).

<sup>79</sup> See, e.g., Deepak Sharma, “What are Outstream Video Ads and How to Get Started With Them?” *AdPushup*, September 7, 2023, available at <https://www.adpushup.com/blog/outstream-video-ads/>; Sean Dougherty, “The 12 types of display ads you need to know,” *Funnel*, August 2, 2023, available at <https://funnel.io/blog/12-types-of-display-ads/>; “The Power of Display Advertising and Why You Should Use It,” *TargetVideo*, March 21, 2023, available at <https://target-video.com/the-power-of-display-advertising-and-why-you-should-use-it/>.

<sup>80</sup> See, e.g., “The Power of Display Advertising and Why You Should Use It,” *TargetVideo*, March 21, 2023, available at <https://target-video.com/the-power-of-display-advertising-and-why-you-should-use-it/>; “In-Stream Video: Definition,” *SmartyAds*, available at <https://smartyads.com/glossary/in-stream-video-definition/> (“The advertisement that is shown before, during or after video watching, the same way it can be displayed during the game or any kind of animation. Such kind of ad appears in the player environment of streamable content, and duration [of] which can reach 15 to 30 seconds.”); Sean Dougherty, and Thomas Frenkiel, “Your guide to display advertising,” *Funnel*, June 19, 2024, available at <https://funnel.io/blog/a-2023-guide-to-display-advertising/> (“Video ads are another common type of display ad that can either take full control of the screen for a period of time (in-stream) or run alongside the video experience (nonlinear).”); see also **Footnote 78** above.



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definition I am using here.<sup>81</sup> Notably, according to the eMarketer data produced in this matter, instream video ads are described as a type of video ad, which is included as part of display advertising.<sup>82</sup>

- **Native ads:** Although there is disagreement about the exact definition of a native ad,<sup>83</sup> these ads typically take on the format or tone of the website or app where the ads are served.<sup>84</sup> Many of these are similar to traditional display ads<sup>85</sup> and are also used

<sup>81</sup> Anindya Ghose, and Vilma Todri-Adamopoulos, “Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior,” *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910 at p. 907 (“For instance, examining the various effects across the different types of display advertising targeting types in our data set, it is evident that some targeting methods (e.g., retargeting advertising) perform better than others (e.g., branding pre-roll video advertising) in increasing consumers’ propensity to make a conversion.”), p. 903 (“During the six-month period of our data set, five different types of display targeting were deployed by the advertiser. [...] Moreover, branding pre-roll advertising, which entails a limited 15- to 30-second video advertisement auto-playing before a user-selected video content, has a strong positive and significant effect on the consumers’ propensity to visit the advertiser’s website through organic search results [...].”).

<sup>82</sup> See GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics,” Rows 66, 70) and **Section IV.A**. This directly contradicts Professor Gans’s claim to exclude instream video ads from “open web” display advertising. See Gans Report, ¶ 255.

<sup>83</sup> See, e.g., [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

<sup>84</sup> See, e.g., “Native ads: Definition,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/7009059?hl=en>.

<sup>85</sup> eMarketer includes ad spending on Facebook’s News Feed Ads and X’s Promoted Posts in its calculation of “Display ad spending.” See GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”). Further, Facebook’s News Feed Ads and X’s Promoted Posts are examples of native ads. See Lara O’Reilly, “Facebook wants to turn its mobile ad network into an even bigger business by running ‘native’ ads on other apps,” *Business Insider*, May 6, 2015, available at <https://www.businessinsider.com/facebook-audience-network-ads-native-ad-tools-2015-5> (“Facebook’s own news feed ads on the Facebook platform are native [...]”); Martin Beck, “How Twitter’s Changing Promoted Tweets To Look More Like Regular Ones,” *MarTech*, April 29, 2015, available at <https://martech.org/new-twitter-makes-promoted-tweets-less-obvious/> (“Promoted Tweets are getting more subtle. Twitter has quietly removed the yellow badge from its main ad unit, hoping to make its native advertising content look a bit more native.”).

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interchangeably (as I noted in my book).<sup>86</sup> A typical example of a native ad would be a sponsored post on a news media website,<sup>87</sup> sponsored ads on Facebook’s newsfeed,<sup>88</sup> or promoted posts on X,<sup>89</sup> as I also noted in my book.<sup>90</sup> Further support that native ads are interchangeable with display ads comes from [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>91</sup> and from companies such as Mediavine, an ad management company<sup>92</sup> that

[REDACTED]

[REDACTED]<sup>93</sup>

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<sup>86</sup> Anindya Ghose, *Tap: Unlocking the Mobile Economy*, MIT Press, 2017 (“Ghose (2017)”) at p. 172 (“Coldwell Banker Real Estate LLC and other advertisers that are moving money out of display ad and embracing native ads are experiencing a 50 percent higher clickthrough rates as these native ads blend seamlessly into the user’s content feed on many websites.”).

<sup>87</sup> “Native advertising: Big money, but potential problems,” *The News Literacy Project*, available at <https://newslit.org/tips-tools/did-you-know-native-ads/> (“[Native advertising] is what journalists call the ‘sponsored content’ that resembles a news article but is paid for by someone trying to sell something.”).

<sup>88</sup> Lara O’Reilly, “Facebook wants to turn its mobile ad network into an even bigger business by running ‘native’ ads on other apps,” *Business Insider*, May 6, 2015, available at <https://www.businessinsider.com/facebook-audience-network-ads-native-ad-tools-2015-5> (“Facebook’s own news feed ads on the Facebook platform are native [.]”).

<sup>89</sup> Martin Beck, “How Twitter’s Changing Promoted Tweets To Look More Like Regular Ones,” *MarTech*, April 29, 2015, available at <https://martech.org/new-twitter-makes-promoted-tweets-less-obvious/> (“Promoted Tweets are getting more subtle. Twitter has quietly removed the yellow badge from its main ad unit, hoping to make its native advertising content look a bit more native.”).

<sup>90</sup> Ghose (2017) at p. 172 (“An advertorial is the simplest version of a native ad. Other simple examples include Twitter’s promoted Tweets, Facebook’s promoted stories, and Tumblr’s promoted posts. We will increasingly see publishers and advertisers working together to produce native ads. Native ads have an inherent advantage because they leverage the context of the content where they appear.”).

<sup>91</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

<sup>92</sup> “Mediavine Will Transition to 100 Percent Server-to-Server Bidding in Q1 2021,” *Mediavine*, January 12, 2021, available at <https://www.mediavine.com/newsroom/mediavine-will-transition-to-100-percent-server-to-server-bidding-in-q1-2021/>.

<sup>93</sup> [REDACTED]  
[REDACTED]

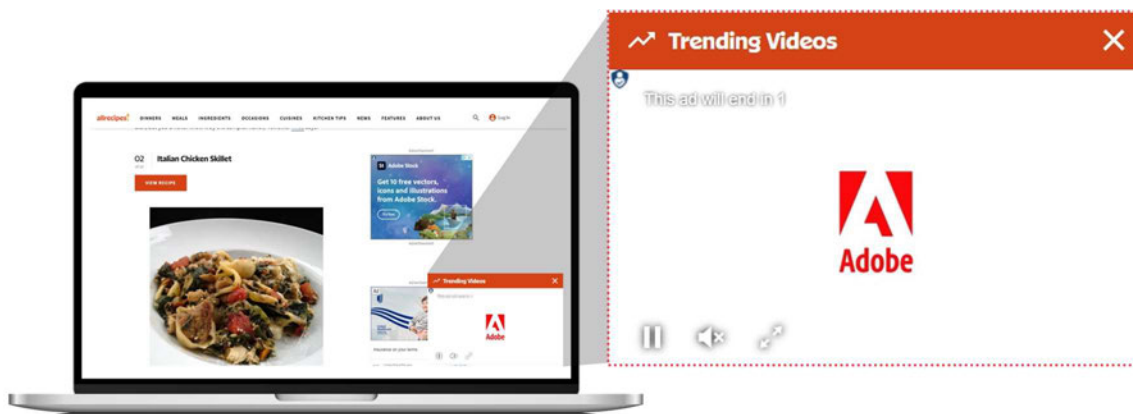
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41. **Figure 4** below provides illustrative examples of the way that the display ad formats described above could appear on websites.

**Figure 4. Examples of Display Ad Formats**

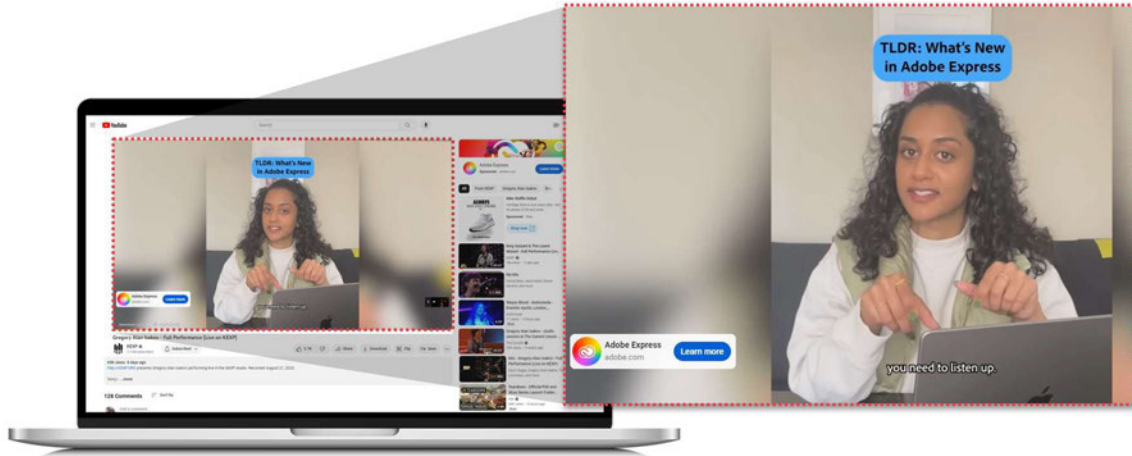


**Image Ad**

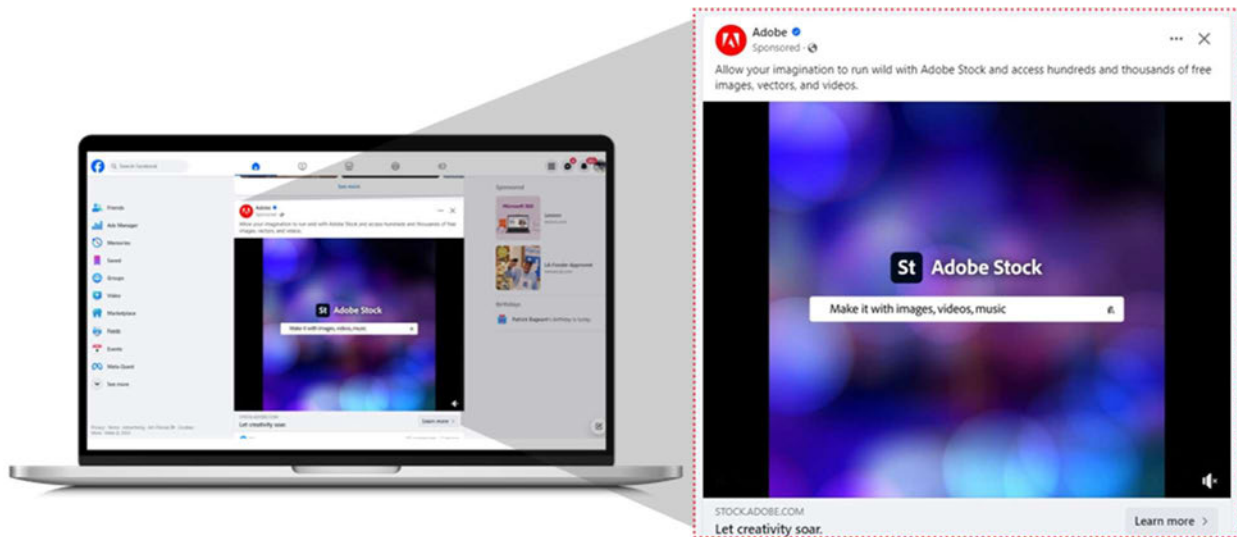


**Outstream Video Ad**

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**Instream Video Ad**



**Native Ad**

42. Professor Gans claims that “it can be inferred that there is relatively low substitutability between display ads and video ads” because “[a]dvertisers need to pick if the campaign is going to utilize display ads or video ads during the very first step of their purchase decision” in the Google Ads interface.<sup>94</sup> But there is no reason to believe that the order of decision in the purchase process on an ad format is an indication of whether or not advertisers might substitute

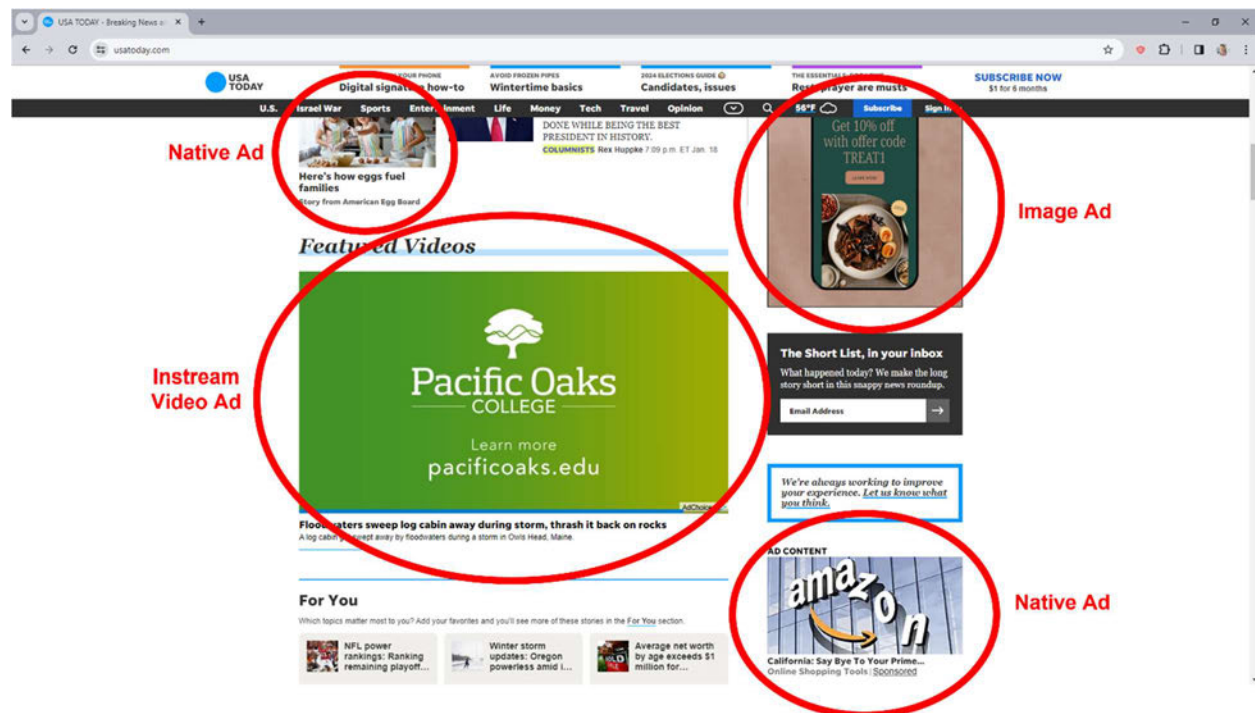
<sup>94</sup> Gans Report, ¶ 77.

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one ad format for another, and Professor Gans cites nothing in support of this proposition. In my experience, companies first develop plans about how to allocate their budgets (including how to allocate between formats, devices, and properties) and then implement those plans through the use of ad buying tools best suited to their chosen strategy. The order in which an advertiser sequences the mechanical steps of setting up a campaign has no bearing on the degree to which the advertiser considers different formats, devices, and properties to be substitutes.

43. As shown in **Figure 5**, a user visiting a single webpage will see differently formatted ads right alongside one another—and some of these ads (image ads) are within the Plaintiffs’ and Plaintiffs’ experts’ definition of “open web display advertising” while others (native and instream video) are not.

**Figure 5. Example of Various Display Ad Formats on USA Today Website**

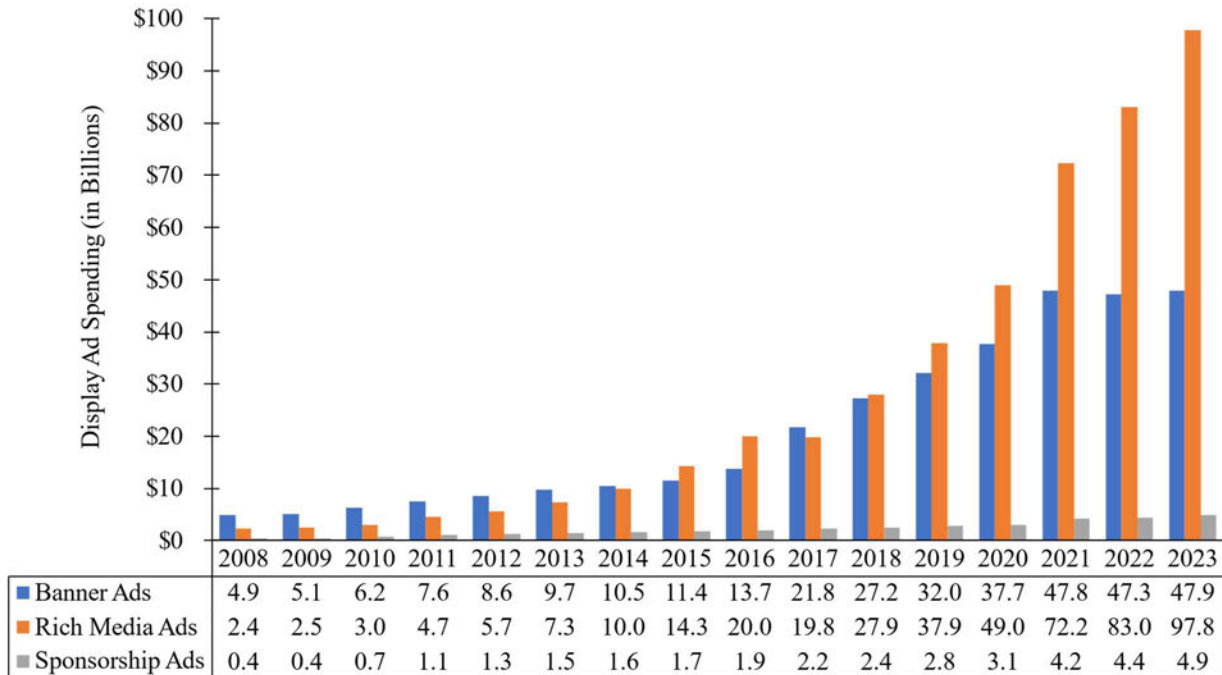


44. **Figure 6** presents a breakdown of display ad spending by format, including banner ads (*i.e.*, text and image ads), rich media ads (including instream video, outstream video, and non-

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video ads<sup>95</sup>), and sponsorship ads.<sup>96</sup> As shown in the figure, banner ads and rich media ads remain important formats for display ads, and the ad spending for rich media ads has outgrown that for banner ads in recent years.

**Figure 6. Display Ad Spending in the U.S. by Format, 2008-2023**



**Notes:**

[1] According to eMarketer, the ad spending presented above includes advertising that appears on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices.

[2] Rich media ads include instream and outstream video ads, and non-video ads that feature various levels of interaction (including scrolling, expanding, or clicking within the ad) such as splash screens, pop-up and pop-under ads, daughter windows, interstitials and superstitials, and digital audio ads.

[3] From 2008 to 2016, instream video ad spending is excluded from rich media ad spending and reported separately as video ad spending in the eMarketer data. For this figure, the total rich media ad spending from 2008 to 2016 is calculated as the sum of rich media ad spending and video ad spending as reported by eMarketer.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

**B. Advertisers buy display ads on a variety of publisher properties that serve similar functions.**

45. Plaintiffs’ experts focus on so-called “open web display advertising” as “distinct” from advertising on mobile apps and on websites using integrated advertising tools (as well as distinct



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from advertising in the formats set out above).<sup>97</sup> However, in reality, advertisers buy display advertising across a multitude of properties including not only what Plaintiffs refer to as “open web” websites, but also properties that the Plaintiffs and their experts exclude, such as mobile apps, social media platforms, retailer platforms, and streaming services. It is my opinion, based on my experience and the evidence in this matter discussed in **Section IV**, that many advertisers and publishers do not see these properties as “distinct.” For instance, when [REDACTED]

[REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED].<sup>98</sup>

46. As I describe below, Plaintiffs’ experts’ distinctions between “open web” and ads on other properties and devices fail to recognize that the digital landscape has evolved rapidly over the last few decades, resulting in an ever-increasing number of options for advertisers to choose from to reach their desired audiences. This is particularly the case as users have increased their engagement on these different properties over time. Plaintiffs’ experts ignore the reality of how

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<sup>95</sup> eMarketer description of “Rich media other ad spending”: “includes nonvideo ads which feature various levels of interaction (including scrolling, expanding, or clicking within the ad) such as splash screens, pop-up and pop-under ads, daughter windows, interstitials and superstitials, and digital audio ads for all formats mentioned; appears on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices.” See GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics,” Row 72). Rich media ads come in many different formats. See, e.g., “What is rich media?” *Google Studio Help*, available at <https://support.google.com/richmedia/answer/2417545>; “How Are Rich Media Ads Different From Other Ad Formats?” *CodeFuel*, April 17, 2023, available at <https://www.codefuel.com/blog/how-rich-media-ads-different-other-ad-formats/>.

<sup>96</sup> Sponsorship is where an advertiser pays to have both ads and content (such as logos, articles, and videos) on a website. See, e.g., “Sponsorships,” *The Online Advertising Guide*, available at <https://theonlineadvertisingguide.com/ad-size-guide/sponsorships/>.

<sup>97</sup> Gans Report, ¶¶ 75-92.

<sup>98</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

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this context has influenced advertiser behavior to paint a siloed and static view of the digital advertising landscape.

47. From the 2000s onward, social media companies, like Facebook, X (formerly Twitter), and TikTok, launched sophisticated ad platforms that have allowed advertisers to target their desired audiences. Certain streaming media companies, initially focused on ad-free subscription models, began employing ad sales to diversify their revenue streams, with companies like Disney (which acquired Hulu in 2019<sup>99</sup>), Roku, and Netflix evolving into major players in digital advertising. Retailers, such as Amazon and Walmart, transformed their e-commerce platforms into lucrative ad spaces, offering sponsored product placements and using their deep understanding of consumer buying habits. Over the last two decades, these firms have leveraged their user data to capture a share of the growing digital ad revenue pie, which has evolved and continues to evolve over time. Many of these publishers have launched self-service advertising platforms to promote and sell advertising space on their owned-and-operated properties, while also offering advertisers those same platforms to facilitate the sale of advertising space on third-party properties, just like Google. Thus, contrary to Plaintiffs' claim that "Google uses its powerful position on every side of online display markets to unlawfully exclude competition,"<sup>100</sup> a wide variety of companies have begun to offer ad tech products and services, providing advertisers with many ways to reach their desired audiences.

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<sup>99</sup> Jill Disis, "Disney is taking full control of Hulu," *CNN Business*, May 14, 2019, available at <https://www.cnn.com/2019/05/14/media/disney-buys-comcast-hulu-ownership/index.html>.

<sup>100</sup> Complaint, ¶ 6.



***1. The rapid consumer adoption of mobile devices has allowed publishers to reach new and existing users via mobile apps, and for advertisers to make campaigns more effective by reallocating spending between web and in-app ads.***

- a. The migration from desktop to mobile in the U.S. and the proliferation of apps created new channels for advertisers and publishers.

48. Plaintiffs' experts acknowledge the rapid adoption among U.S. users of mobile devices in the late 2000s and early 2010s,<sup>101</sup> but they fail to recognize how increased mobile usage opened up an alternative channel for publishers and advertisers to find a "match." As depicted in **Figure 7**, smartphone ownership in the U.S. rose from just 2% of U.S. cellular subscribers in 2005 to 11% in 2008 (a year after the release of the first iPhone<sup>102</sup> and the year of release of the first Android smartphone<sup>103</sup>), to over 50% by 2012, and to over 80% as of 2016.<sup>104</sup> As noted above, according to a 2022 Gallup survey of 30,000 U.S. adults, 97% of respondents reported owning a smartphone.<sup>105</sup> The number of smartphone users in the U.S. also increased to 302 million in 2021 and was expected to grow to 311.8 million in 2023.<sup>106</sup> As these data indicate, smartphone usage increased most dramatically during the 2008 to 2012 period.

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<sup>101</sup> Chandler Report, ¶ 75 ("As smartphone adoption skyrocketed in the late 2000s, marketers quickly recognized the untapped potential of mobile apps as a powerful medium for direct consumer engagement."); Gans Report, ¶ 73 ("As mobile devices became popular and as social media emerged, other types of online advertising started to sprout. These distinct types of online advertising include display, search, social media, in-stream video, and in-app advertising.").

<sup>102</sup> Jennifer Korn, and Marie Barbier, "A look back at every iPhone ever," *CNN Business*, September 11, 2023, available at <https://www.cnn.com/2023/09/11/tech/iphone-timeline/index.html>.

<sup>103</sup> Peter Butler, "15 Years of Android: Comparing the Newest Android Phone to the First," *CNET*, September 27, 2023, available at <https://www.cnet.com/pictures/15-years-of-android-comparing-the-newest-android-phone-to-the-first/>.

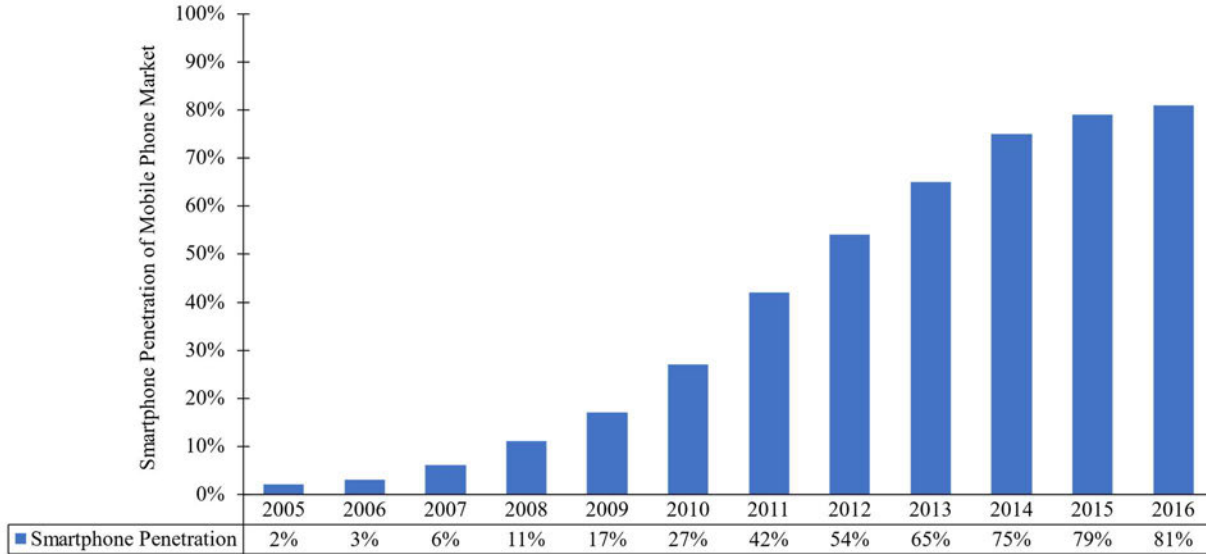
<sup>104</sup> "U.S. Smartphone Penetration Surpassed 80 Percent in 2016," *Comscore*, February 3, 2017, available at <https://www.comscore.com/Insights/Blog/US-Smartphone-Penetration-Surpassed-80-Percent-in-2016>.

<sup>105</sup> Lydia Saad, "Americans Have Close but Wary Bond With Their Smartphone," *Gallup*, June 20, 2022, available at <https://news.gallup.com/poll/393785/americans-close-wary-bond-smartphone.aspx>.

<sup>106</sup> Federica Laricchia, "Number of smartphone users in the United States from 2009 to 2040," *Statista*, October 18, 2022, available at <https://www.statista.com/statistics/201182/forecast-of-smartphone-users-in-the-us/>.

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**Figure 7. Growth of Smartphone Ownership in the U.S.**



**Notes:**

[1] According to the source, the figure above is for the U.S., age 13+, and is calculated using 3-month averages ending December of each year.

**Source:** “U.S. Smartphone Penetration Surpassed 80 Percent in 2016,” *Comscore*, February 3, 2017, available at <https://www.comscore.com/Insights/Blog/US-Smartphone-Penetration-Surpassed-80-Percent-in-2016>.

49. With the growth in ownership of smartphones, developers released an ever-increasing number of smartphone apps, leading to the creation of the “app economy” in which established firms began offering apps as new ways to interact with customers and entirely new firms emerged to serve customers in new ways.<sup>107</sup> Apple’s App Store opened in July 2008 with 500 apps initially available.<sup>108</sup> Within a year, there were more than 100,000 apps available in the App Store.<sup>109</sup> By 2013, there were over 1 million apps available on the Google Play Store, and nearly

<sup>107</sup> Ghose (2017) at p. 27 (“Thanks to mobile apps, brands in many industries have lower barriers to entry and can scale up quickly. Take the sharing economy (or the collaborative economy, as some experts call it), for example. Perhaps the most profound enabler of the sharing economy has been mobile apps. In the absence of smartphones, it is anybody’s guess if these innovative solutions would have seen the light of the day.”).

<sup>108</sup> AppleInsider Staff, “Apple’s App Store launches with more than 500 apps,” *Apple Insider*, July 10, 2008, available at [https://appleinsider.com/articles/08/07/10/apples\\_app\\_store\\_launches\\_with\\_more\\_than\\_500\\_apps](https://appleinsider.com/articles/08/07/10/apples_app_store_launches_with_more_than_500_apps).

<sup>109</sup> “Apple Announces Over 100,000 Apps Now Available on the App Store,” *Apple Newsroom*, November 4, 2009, available at <https://www.apple.com/newsroom/2009/11/04Apple-Announces-Over-100-000-Apps-Now-Available-on-the-App-Store/>.

that many in the Apple App Store.<sup>110</sup> In that same year, 3.1 billion apps were downloaded worldwide from these two leading app stores.<sup>111</sup> The Samsung Galaxy Store, which opened in September 2009,<sup>112</sup> reached 24 million monthly active users in 2017.<sup>113</sup>

50. Since 2012, an ever-increasing share of total internet usage has been on mobile devices. In 2022, mobile internet usage in the United States reached an all-time high with over 282.5 million users.<sup>114</sup> And mobile device users spend a large fraction of their time on apps. According to an eMarketer study, in 2020, mobile users were predicted to have spent 88% of their time using mobile internet within apps.<sup>115</sup>

51. **Figure 8** presents a breakdown of display ad spending by device, including desktop/laptop, mobile, and CTV. As shown in the figure, mobile ad spending has witnessed significant growth over the past decade and has become the major driver of the growth in display ad spending in recent years.

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<sup>110</sup> Christina Warren, “Google Play Hits 1 Million Apps,” *Mashable*, July 24, 2013, available at <https://mashable.com/2013/07/24/google-play-1-million/>.

<sup>111</sup> Anindya Ghose, and Sang Pil Han, “Estimating Demand for Mobile Applications in the New Economy,” *Management Science*, Vol. 60, No. 6, 2014, pp. 1470-1488 at p. 1473.

<sup>112</sup> Priya Ganapati, “Samsung Joins the App Store Party,” *WIRED*, August 31, 2009, available at <https://www.wired.com/2009/08/samsung-app-store/>.

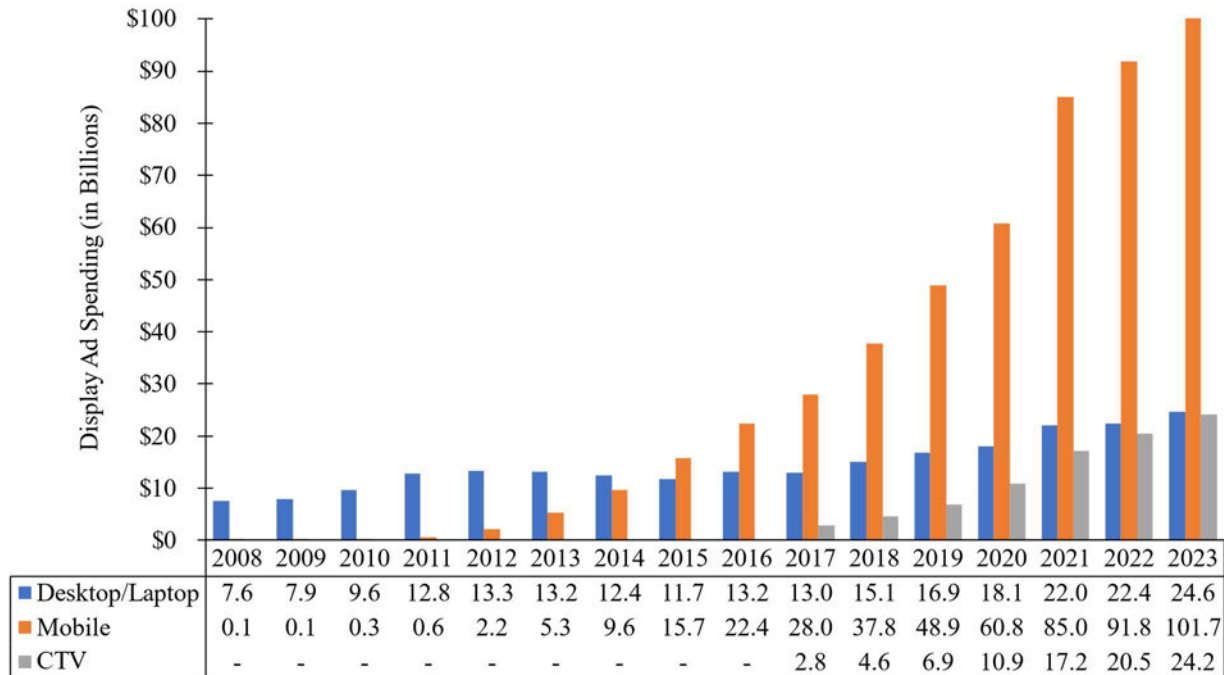
<sup>113</sup> Dean Takahashi, “Samsung Galaxy App Store gains ground in the U.S. with each smartphone launch,” *VentureBeat*, April 22, 2017, available at <https://venturebeat.com/mobile/samsung-galaxy-app-store-gains-ground-in-the-u-s-with-each-smartphone-launch/>.

<sup>114</sup> Laura Ceci, “Mobile internet usage in the United States – Statistics & Facts,” *Statista*, March 27, 2024, available at <https://www.statista.com/topics/3124/mobile-internet-usage-in-the-united-states/>.

<sup>115</sup> Yoram Wurmser, “The Majority of Americans’ Mobile Time Spent Takes Place in Apps,” *Insider Intelligence*, July 9, 2020, available at <https://www.insiderintelligence.com/content/the-majority-of-americans-mobile-time-spent-takes-place-in-apps>.

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**Figure 8. Display Ad Spending in the U.S. by Device, 2008-2023**



**Notes:**

[1] Desktop/laptop ads include advertising that appears on desktop and laptop computers and other non-mobile internet-connected devices.

[2] Mobile ads include advertising that appears on mobile phones, tablets, and mobile internet-connected devices.

[3] CTV ads include advertising that appears on CTV devices (e.g., display ads that appear on home screens and instream video ads that appear on CTVs) and exclude network-sold inventory from traditional linear TV and addressable TV advertising.

[4] Entries with “-” denote data unavailable in the corresponding category/period.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

52. Advertisers can display their ads on websites that users access via browsers on their smartphones or tablets (“mobile web” advertising) or within the interface of mobile applications (“mobile in-app” advertising). Both methods are important in the mobile advertising landscape, offering advertisers diverse channels to connect with their target audience, but Plaintiffs’ experts treat them as though they are entirely distinct, counting mobile web ads as part of their definition of “open web,” while leaving mobile in-app ads out.<sup>116</sup>

<sup>116</sup> Gans Report, ¶¶ 88-89; Chandler Report, ¶ 78.

53. As mobile apps proliferated, new opportunities arose for publishers. Historically, publishers that could reach users only through websites could now also reach new and existing users via mobile apps. Publishers have seized those opportunities by investing in moving their users from websites to apps.<sup>117</sup> For example, Facebook began as a web-only publisher, but it has shifted its user base to its app to take advantage of improved metrics associated with app use.<sup>118</sup> Other examples of websites that developed mobile apps with in-app advertising include The New York Times,<sup>119</sup> The Washington Post,<sup>120</sup> The New Yorker, H&M, Blue Apron, Calendly, and Canva.<sup>121</sup> A study by Criteo shows that mobile apps drive 70% of mobile sales for those retailers who invest in both mobile web and shopping apps.<sup>122</sup> By offering unique content and features on apps, publishers provide an incentive for users to increase their time spent on the app compared to the web.<sup>123</sup> Publishers also use linking from their website to their apps on app stores (as well as other methods) to drive movement of users from the web to apps.<sup>124</sup>

54. As publishers and users move to apps, studies have shown that advertisers have correspondingly shifted their spending from web-based advertising to in-app advertising. As of March 2023, in-app advertising has constituted 45% of the total mobile ad spending compared to

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<sup>117</sup> “Tips to convert your web traffic to mobile app users and retain them,” *AppMySite*, available at <https://www.appmysite.com/blog/tips-to-convert-your-web-traffic-to-mobile-app-users-and-retain-them/>.

<sup>118</sup> Dan Rowinski, “Why Facebook Ditched the Mobile Web & Went Native With its New iOS App,” *Readwrite*, August 23, 2012, available at <https://readwrite.com/how-facebook-ditched-the-mobile-web-went-native-with-its-new-ios-app/>.

<sup>119</sup> See **Figure 9**.

<sup>120</sup> WashPostPR, “The Washington Post to roll out ‘fastest mobile news site,’” *The Washington Post*, September 6, 2016, available at <https://www.washingtonpost.com/pr/wp/2016/09/06/the-washington-post-to-roll-out-fastest-mobile-news-site/>.

<sup>121</sup> Kate Orekhova, “How to Convert Your Website Into an App [+ 5 Brands That Did It],” *HubSpot*, January 5, 2024, available at <https://blog.hubspot.com/website/how-to-convert-website-into-mobile-app>.

<sup>122</sup> “Global Commerce Review United States, Q1 2018,” *Criteo*, available at [https://www.criteo.com/wp-content/uploads/2018/05/18\\_GCR\\_Q1\\_Report\\_US\\_ENG.pdf](https://www.criteo.com/wp-content/uploads/2018/05/18_GCR_Q1_Report_US_ENG.pdf).

<sup>123</sup> Alekh Verma, “Learn How To Turn Your Website Traffic Into Mobile Downloads And Retain Users,” *eSearch Logix*, August 7, 2023, available at <https://www.esearchlogix.com/tech/turn-website-traffic-into-mobile-downloads/>.

<sup>124</sup> Alekh Verma, “Learn How To Turn Your Website Traffic Into Mobile Downloads And Retain Users,” *eSearch Logix*, August 7, 2023, available at <https://www.esearchlogix.com/tech/turn-website-traffic-into-mobile-downloads/>.

32% in 2017.<sup>125</sup> The benefits of migrating to in-app advertising include improved user experience, enhanced customer loyalty, and increased business visibility.<sup>126</sup>

- b. Advertisers reallocate spending between in-app and web display ads to maximize campaign success.

55. Mobile in-app ads can be delivered in a variety of ways, including but not limited to interstitial video ads (*i.e.*, full-screen ads served to users in between sessions of a mobile app), rewarded video ads (*i.e.*, full-screen ads served to users in exchange for premium content delivered in-app), pre-, mid-, or post-roll ads (*i.e.*, ads played before, during, or after videos streamed through apps),<sup>127</sup> native ads that are embedded in in-app content (*e.g.*, a sponsored post in an Instagram Feed), or banner ads that appear on-screen within the app.<sup>128</sup>

56. In-app advertising shares many similarities with web advertising, making it a versatile and suitable alternative for advertisers to reach their target audiences. Both in-app and web ads rely on visual engagement, utilizing formats like banners, interstitials, and videos to capture user attention. To illustrate this similarity, **Figure 9** shows an example of two recent ads that were served to the same user on the New York Times website and on the New York Times app.

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<sup>125</sup> Reagan McNameeKing, “Back to Basics: mobile web vs. mobile in-app advertising,” *Verve Group*, May 18, 2023, available at <https://verve.com/blog/back-to-basics-mobile-web-vs-mobile-in-app-advertising/>.

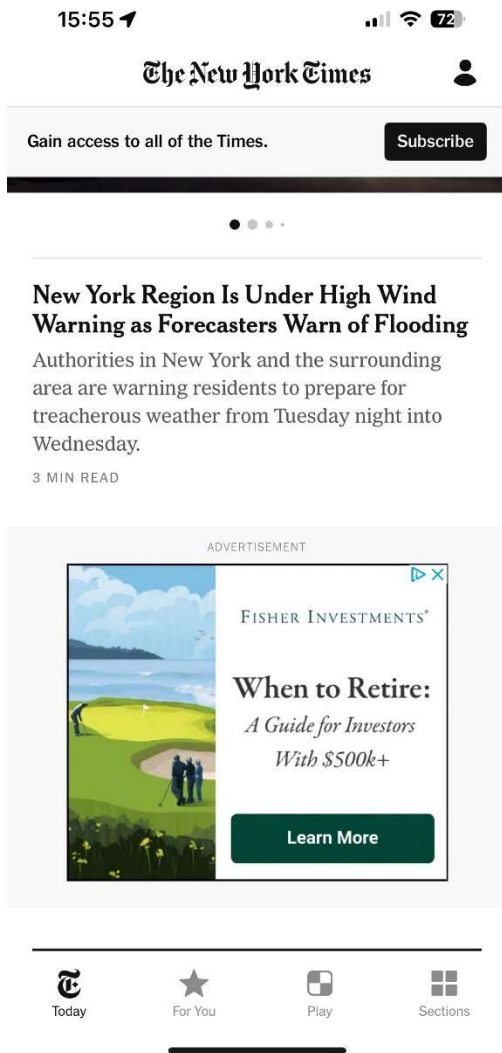
<sup>126</sup> “From Website to App: Why Migrating Can Skyrocket Your Business,” *Appticz*, March 2, 2023, available at <https://www.linkedin.com/pulse/from-website-app-why-migrating-can-skyrocket-your-business-appticz/>.

<sup>127</sup> Marta Grgurović, “What Are Pre-Roll Ads and Why Publishers Love Them,” *TargetVideo*, March 14, 2024, available at <https://target-video.com/pre-roll-ads/>.

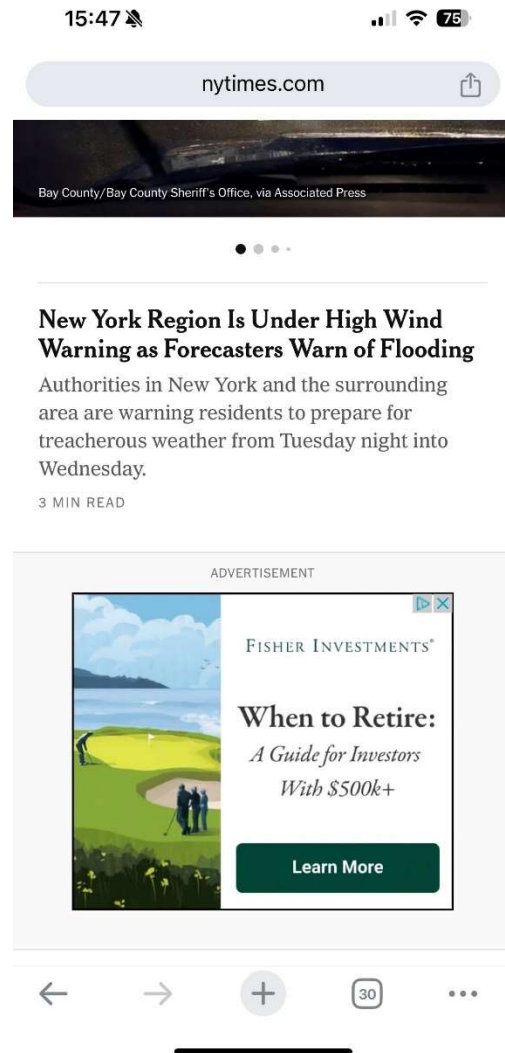
<sup>128</sup> Shubham Grover, “In-App Advertising: The Complete Guide,” *AdPushup*, April 23, 2024, available at <https://www.adpushup.com/blog/in-app-advertising/>.

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**Figure 9. Display Ads on the New York Times Website and New York Times App**



**New York Times App**



**New York Times Website**

57. This similarity in formats allows advertisers to create cohesive ad campaigns that span both the web and mobile apps. For example, an [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



[REDACTED]<sup>129</sup> [REDACTED]

[REDACTED]<sup>130</sup> Furthermore, both web and mobile apps offer sophisticated targeting options, leveraging user data to deliver personalized ad experiences. In my book, I offered recommendations to practitioners regarding allocation of digital advertising dollars between web and mobile app channels.<sup>131</sup>

58. In addition, many companies offer ad tech tools that can be used for both the web (including desktop and mobile) and in-app advertising.<sup>132</sup> Examples include both sell-side tools for publishers, such as Magnite’s SSP,<sup>133</sup> Microsoft Xandr’s Monetize SSP,<sup>134</sup> and Google’s Ad Manager,<sup>135</sup> and ad-buying tools for advertisers, such as The Trade Desk,<sup>136</sup> Amazon DSP,<sup>137</sup>

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<sup>129</sup> [REDACTED]

<sup>130</sup> [REDACTED]

<sup>131</sup> Ghose (2017) at p. 166 (“These numbers provide advertisers a starting point for finding the optimal allocation of budget across the Web and mobile channels[.]”).

<sup>132</sup> See, e.g., “Meet your new partner.” *Google Ad Manager*, available at <https://admanager.google.com/home/partner-solutions/>; “Not all supply partners are the same. We’ll help you reach more of the audiences you care about, more efficiently than ever.” *Magnite*, available at <https://www.magnite.com/buyers/>.

<sup>133</sup> [REDACTED]

<sup>134</sup> Xandr Monetize SSP allows advertisers to target inventory types like App & Web, App Only, or Web Only. See “Supply type targeting,” *Xandr Platform*, March 6, 2024, available at [https://docs.xandr.com/bundle/monetize\\_monetize-standard/page/topics/supply-type-targeting.html](https://docs.xandr.com/bundle/monetize_monetize-standard/page/topics/supply-type-targeting.html).

<sup>135</sup> In a case study on a native ad format, The New York Times used Google Ad Manager to “to compile and build responsive ads that scale[d] to mobile web, desktop, and app.” See “Growing engagement with native ads: The New York Times’ approach,” *Google Ad Manager*, available at <https://admanager.google.com/home/success-stories/new-york-times-native-ads-case-study/>.

<sup>136</sup> “Four benefits of omnichannel advertising that you might be missing out on,” *The Trade Desk*, June 7, 2022, available at <https://www.thetradedesk.com/us/resource-desk/four-benefits-of-omnichannel-advertising-that-you-might-be-missing-out-on> (“We at The Trade Desk are your one-stop shop to plan, execute, and measure omnichannel campaigns. Our platform has a global reach with premium inventory in Connected TV providers, online video, display advertising, audio, gaming, and digital out-of-home. Save time by enabling single-platform setup, with simultaneous access to optimizations across multiple channels and inventory sources.”).

<sup>137</sup> “Amazon DSP ad dimensions and specifications,” *Amazon Ads*, available at <https://advertising.amazon.com/resources/ad-specs/dsp> (“Amazon DSP allows advertisers to efficiently reach Amazon shoppers on Amazon sites, across the web, and in mobile apps.”).



59. As further evidenced in **Section IV.B** below, advertisers can and do switch spending between web and in-app advertising. For example, [REDACTED]

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platforms) are used by advertisers for similar purposes as other types of display ads, and advertisers substitute spending across these different formats. In **Section IV.B** below, I provide evidence that advertisers reallocate spending between “open web” and social media properties based on performance, including properties that Plaintiffs’ experts include in what they call “open web display.” In addition, the distinctions raised by Professor Gans and Dr. Chandler between the “open web” and social media sites such as Meta ignore broader market trends, including the rampant adoption of social media by U.S. users since the mid-2000s and therefore the increasing importance of social media platforms as a way for advertisers to reach wide audiences.

61. Social media platforms emerged in the 2000s to connect individuals via the internet, allowing them to communicate and share information and experiences. Several social media platforms, including Facebook, Instagram, X, LinkedIn, Pinterest, Snapchat, and TikTok generate revenue by offering advertisers new ways to reach audiences.<sup>144</sup> Social media companies typically offer advertisers self-service platforms to purchase ads and track the ROI from their marketing campaigns.<sup>145</sup> These self-service platforms are integrated, internally developed ad tech tools that publishers use to sell their owned-and-operated inventory and, in several cases, also ad inventory of third-party publishers.<sup>146</sup>

62. Notably, social media platforms use data that they collect directly about what users “like” and with whom users are connected to match those users to targeted ads.<sup>147</sup> These targeting

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<sup>144</sup> Ali Abdallah Alalwan, “Investigating the impact of social media advertising features on customer purchase intention,” *International Journal of Information Management*, Vol. 42, 2018, pp. 65-77; Hilde A. M. Voorveld, Guda van Noort, Daniël G. Muntinga, and Fred Bronner, “Engagement with Social Media and Social Media Advertising: The Differentiating Role of Platform Type,” *Journal of Advertising*, Vol. 47, No. 1, 2018, pp. 38-54; Bayu Dwinanda, Fandi Andi Syaripuddin, Hudaifi, and Evelyn Hendriana, “Examining the Extended Advertising Value Model: A Case of TikTok Short Video Ads,” *Mediterranean Journal of Social & Behavioral Research*, Vol. 6, No. 2, 2022, pp. 35-44.

<sup>145</sup> Jonathan Durante, “Three Reasons You Should Be Advertising On Social Media in 2021,” *Forbes*, March 12, 2021, available at <https://www.forbes.com/sites/forbesagencycouncil/2021/03/12/three-reasons-you-should-be-advertising-on-social-media-in-2021/>.

<sup>146</sup> Gans Report, ¶ 273 (“WGP ad buying tools only operate within the publisher’s owned and operated platform”), Footnote 225 (“Until 2020, Meta offered ‘Facebook Audience Network’ (FAN), an ad tech tool that facilitated the purchase of open web display advertising. Today, Meta offers Meta Audience Network, a tool that focuses on the purchase of advertising on Meta own and operated properties and third-party mobile apps.”).

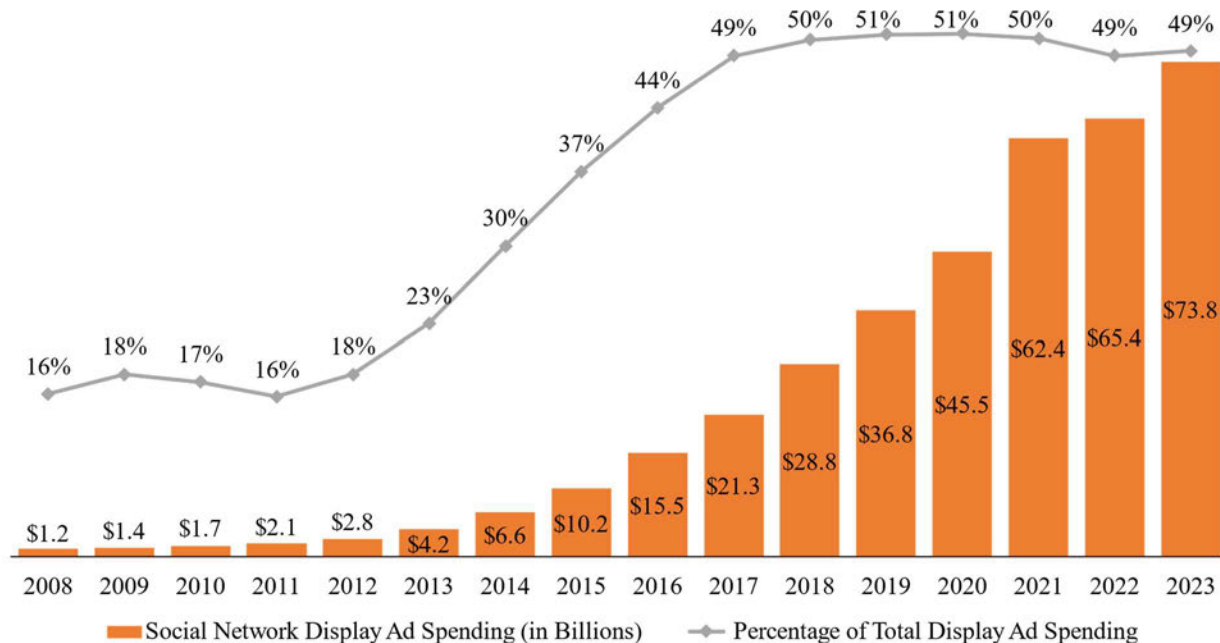
<sup>147</sup> Erik Huberman, “First-Party Data Collection Is More Crucial Than Ever,” *Forbes*, December 20, 2021, available at <https://www.forbes.com/sites/forbesagencycouncil/2021/12/20/first-party-data-collection-is-more->

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capabilities and the growing number of users on social media platforms (often via mobile app<sup>148</sup>) enabled ad spending on social media platforms to grow rapidly over the years.

63. **Figure 10** depicts the growth of U.S. display ad spending on Meta, X, TikTok, and other social networks, illustrating the growing importance of this property that Plaintiffs’ experts choose to artificially exclude.

**Figure 10. Social Network Display Ad Spending in the U.S., 2008-2023**



**Notes:**

[1] eMarketer does not report social network display ad spending. It is calculated by adding the display ad revenues of Meta, LinkedIn, Snapchat, X, and TikTok (accounting for over 80% of the total social network display ad spending from 2012 onwards), and digital ad revenues of Pinterest, Reddit, and other social venues (as display ad revenue data are unavailable for these companies).

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

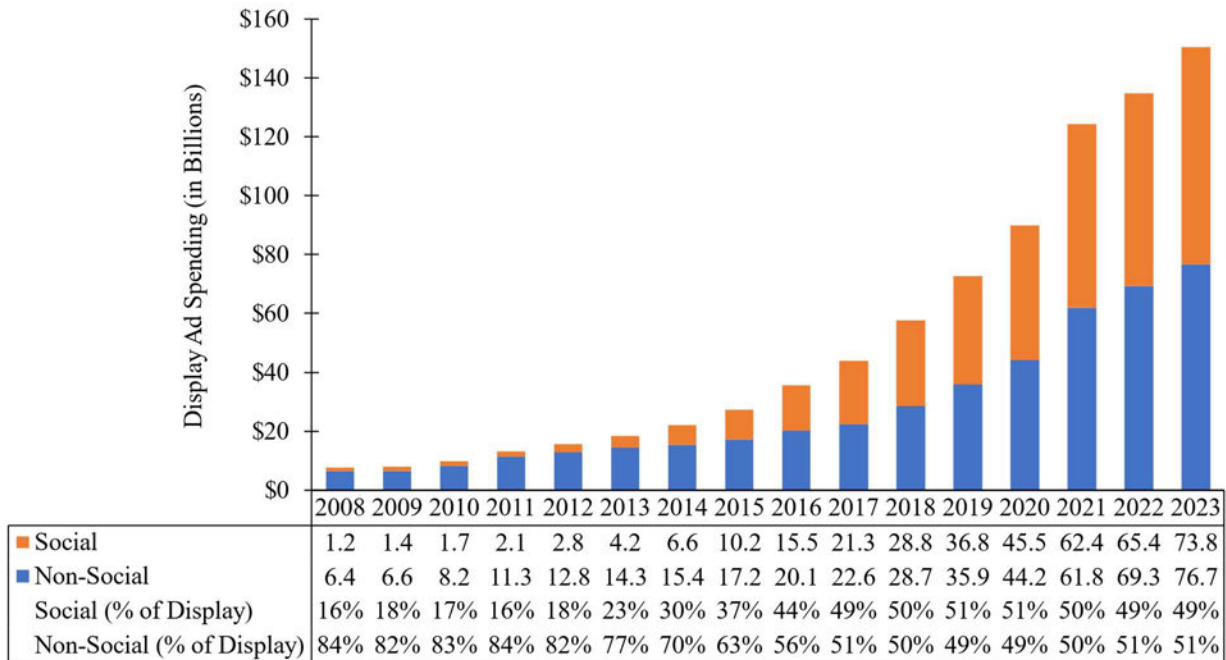
crucial-than-ever/; “Connection Targeting,” *AdvertiseMint*, available at <https://www.advertisemint.com/definition/connection-targeting/>.

<sup>148</sup> For example, as of 2023, over 98% of Facebook users used mobile devices to access Facebook, including over 80% that accessed Facebook via smartphones only. See Rohit Shewale, “Facebook Statistics & Trends To Know In 2024,” *DemandSage*, January 12, 2024, available at <https://web.archive.org/web/20240215223919/https://www.demandsage.com/facebook-statistics/>.

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64. **Figure 11** shows the split of social and non-social display ad spending in the U.S. over time:

**Figure 11. Social and Non-Social Display Ad Spending in the U.S., 2008-2023**



**Notes:**

[1] eMarketer does not report social network display ad spending. It is calculated by adding the display ad revenues of Meta, LinkedIn, Snapchat, X, and TikTok (accounting for over 80% of the total social network display ad spending from 2012 onwards), and digital ad revenues of Pinterest, Reddit, and other social venues (as display ad revenue data are unavailable for these companies).

[2] eMarketer does not report non-social network display ad spending. It is calculated as follows: non-social network display ad spending = display ad spending – social network display ad spending (calculated above).

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

65. By narrowly focusing on what they call “open web display advertising” and artificially excluding social media platforms and other popular online destinations, Plaintiffs’ experts ignore (i) how advertisers reallocate spending between what Plaintiffs’ experts classify as “open web” properties and highly popular social media properties like Meta, TikTok, X, and many others based on respective performance, and (ii) the competition between Google and social media platforms for display ad spending. This makes Plaintiffs’ experts’ opinions contrary to market realities in display advertising, as evidenced by the documents and testimony in the record.

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a. Meta

66. Meta (formerly known as Facebook) launched in 2004. Over the years, Meta expanded its services beyond the Facebook website to the Facebook app, Instagram, Messenger, and WhatsApp.<sup>149</sup> The number of Facebook users has grown rapidly over time—from 154 million monthly active users in the U.S. and Canada in 2010 to 271 million monthly active users in 2023, providing advertisers with an increasingly large audience.<sup>150</sup> **Figure 12** shows the growth of Meta’s display ad revenue over time, increasing from \$200 million in 2008 to \$56.8 billion in 2023. Google has recognized that, for its display ads business, Meta is a “core competitive threat[.]”<sup>151</sup> Many advertisers have been allocating and reallocating their ad spending between Google and Meta based on their measurement of the return on ad spending (*see Section IV.B* below). For example, in 2017, Google found “increasing evidence, both directly from advertisers and agencies that [Facebook] is winning [a] larger proportion of incremental online ads dollars. [...] The competitive analysis team suggests that FB is effectively competing on ROI with their in-depth audience profiles and more aggressive attribution.”<sup>152</sup> Internal strategy documents show that Google’s display ad business competes with Facebook and Instagram for advertisers’ display ad dollars (*see Section IV.B* below),<sup>153</sup> and [REDACTED]<sup>154</sup>

<sup>149</sup> “Your customers are here. Find them with Meta ads,” *Meta ads*, available at <https://www.facebook.com/business/ads>.

<sup>150</sup> Rohit Shewale, “Facebook Statistics & Trends To Know In 2024,” *DemandSage*, January 12, 2024, available at <https://web.archive.org/web/20240215223919/https://www.demandsage.com/facebook-statistics/>.

<sup>151</sup> GOOG-AT-MDL-009766884 at 889, 891 (referring to Meta’s properties Facebook and Instagram).

<sup>152</sup> GOOG-DOJ-03893236 at 236; GOOG-AT-MDL-007451589 at 594 (“Facebook has taken the leadership position from Google over the last four years, capturing a significant share of display market growth.”); GOOG-DOJ-11785945 at 947 (“Facebook has become the dominant player (████ share in 2017) and is expected to continue to grow faster than the market through 2020. Google has been in second place since 2014, and the gap is expected to continue to widen.”).

<sup>153</sup> As of 2018, Google recognized Facebook, Amazon, Twitter, Snapchat, LinkedIn, Pinterest, Spotify, and Reddit, among others, as competitors to Google Ads. *See* GOOG-DOJ-04602586 at 593. As of 2019, Google had received “[s]ignificant seller feedback that advertisers [were] shifting budgets from GDN to Facebook [because] of [Facebook’s LeadGen Display ad] format.” *See* GOOG-DOJ-12700273 at 273. [REDACTED]

[REDACTED] In a 2020 email chain, Google recognized as a challenge to address: Adidas’ shifting spend of “[p]erformance [d]isplay budget[.]” [...] to Facebook” where they could “achieve scale + performance.” *See* GOOG-AT-MDL-003537710 at 710-712. As per a 2020 internal presentation, Facebook’s ad revenue was growing faster than Google’s. *See* GOOG-AT-MDL-009766884 at 891.

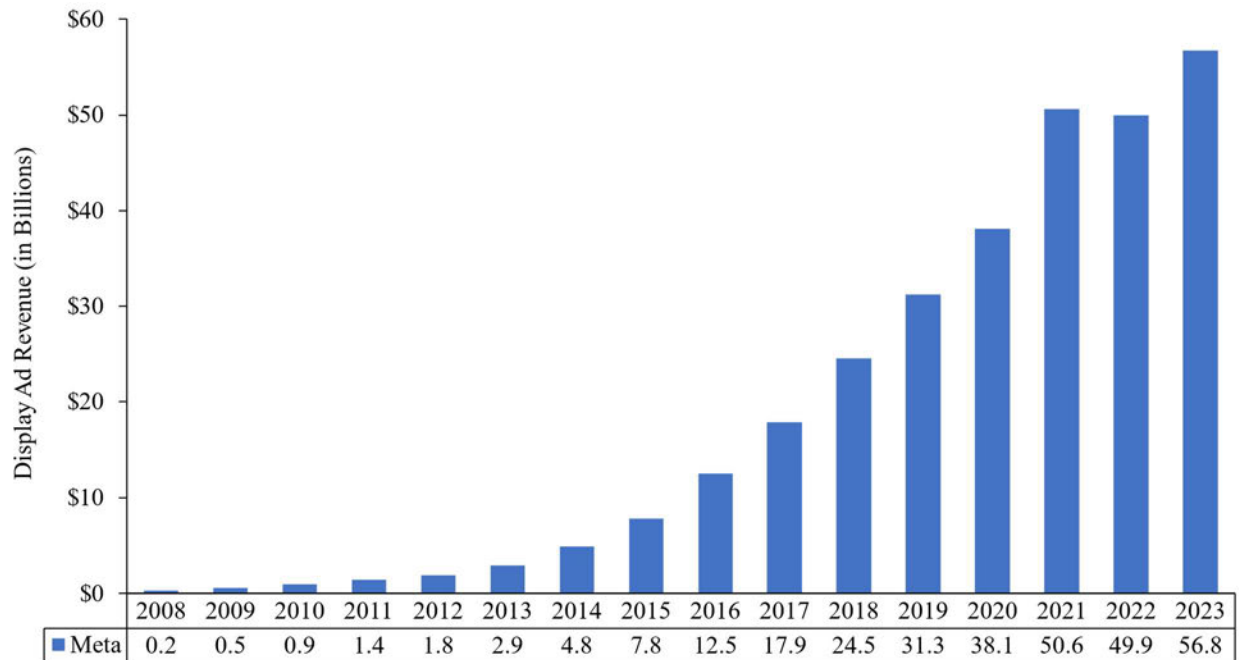
<sup>154</sup> [REDACTED]

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[REDACTED]

[REDACTED] 155

**Figure 12. Meta’s Display Ad Revenue in the U.S., 2008-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices for all display ad formats.

[2] The figure above includes Facebook and Instagram ad revenues.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

67. Advertisers that wish to buy ads on Facebook or Instagram can do so through Meta Ads Manager, Meta’s self-service tool, which enables advertisers to create and manage ad campaigns and which provides analytics and attribution across multiple channels and devices.<sup>156</sup> It allows

[REDACTED]

155 [REDACTED]

<sup>156</sup> “View and analyze ads results in Meta Ads Manager,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/318580098318734>; “Facebook Attribution: A Measurement Tool for

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advertisers to evaluate, among other things, the number of users who have engaged with their ads, demographics of those users (at an aggregated level), and return on ad spending of campaigns.<sup>157</sup> Advertisers can select from multiple ad formats, including but not limited to native ads, banner ads, and interstitial ads.<sup>158</sup> As I noted in my book, an important innovation occurred in 2016 when Facebook announced its Offline Conversion API tool, which allowed retailers to partner with a number of in-store systems companies to track in-store traffic and measure if users bought something that was digitally advertised.<sup>159</sup>

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Today's Digital Advertising Landscape," *Facebook Business*, October 19, 2018, available at <https://www.facebook.com/business/news/facebook-attribution-a-measurement-tool-for-todays-digital-advertising-landscape;> [REDACTED]

<sup>157</sup> "About Using Ads Manager to Understand Ad Performance," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/510910008975690?id=369013183583436>; "View and analyze ads results in Meta Ads Manager," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/318580098318734>; "About maximizing the value of conversions," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/296463804090290?id=561906377587030>; "Navigate to breakdowns in Meta Ads Manager to understand ad performance," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/1798966537090251?id=369013183583436>; "Reporting Tools to Better Measure your Holiday Campaigns," *Meta*, December 6, 2019, available at <https://www.facebook.com/business/news/reporting-tools-to-better-measure-your-holiday-campaigns>.

<sup>158</sup> Song Qian, "Introducing Facebook's Audience Network," *Meta*, April 30, 2014, available at <https://developers.facebook.com/blog/post/2014/04/30/audience-network/>; Josh Constine, "Facebook Opens Its Mobile Ad 'Audience Network' To All Advertisers And Apps," *TechCrunch*, October 7, 2014, available at <https://techcrunch.com/2014/10/07/facebook-audience-network-ads/>; "Create a Poll ad from Meta Ads Manager," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/437605740190763?id=603833089963720>; "A New Way to Buy In-Stream Video Ads on Facebook and Audience Network," *Facebook Business*, August 18, 2017, available at <https://www.facebook.com/business/news/a-new-way-to-buy-in-stream-video-ads-on-facebook-and-audience-network>; "Introducing New Ways to Inspire Holiday Shoppers with Video," *Facebook Business*, July 10, 2018, available at <https://www.facebook.com/business/news/introducing-new-ways-to-inspire-holiday-shoppers-with-video>; "Introducing Facebook Stories Ads," *Facebook Business*, September 26, 2018, available at <https://www.facebook.com/business/news/introducing-facebook-stories-ads>; "Reach people who are actively shopping with ads in Facebook Search Results," *Meta*, October 17, 2019, available at <https://www.facebook.com/business/news/reach-people-who-are-actively-shopping-with-ads-in-facebook-search-results>.

<sup>159</sup> Ghose (2017) at p. 170 ("In June 2016, Facebook announced its Offline Conversion API tool that lets retailers partner with a number of in-store systems companies including Square, IBM, Marketo, and Lightspeed to track in-store traffic and measure if users bought something that was recently advertised in their area in the digital domain. By virtue of including a native store locator for mobile ads, Facebook is also enabling advertisers to more accurately measure their campaigns' effect on in-store sales with new features and metrics.").



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68. In 2014, Facebook Audience Network (FAN)—later rebranded as Meta Audience Network (MAN)—was launched.<sup>160</sup> Meta Audience Network enables advertisers to expand their ad campaigns off of Facebook and Instagram by purchasing ad inventory on properties owned and operated by third-party publishers.<sup>161</sup> Meta Audience Network allowed advertisers to leverage data on Meta users (*e.g.*, biographical, interest, and activity data) to target their desired audiences effectively across not only Meta’s own properties, but also the websites and apps of third parties.<sup>162</sup> According to a 2020 Google Ad Manager strategy document, “Facebook understands what users like and has developed some of the most sophisticated targeting capabilities in the industry.”<sup>163</sup> According to that same document, Meta Audience Network had become an “established monetization partner for publishers” and was estimated to attract between \$4.5 billion and \$5 billion of ad spending in 2018.<sup>164</sup>

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<sup>160</sup> Tanya Chen, “Audience Network Launch,” *Meta*, October 7, 2014, available at <https://developers.facebook.com/blog/post/2014/10/07/audience-network/>; “Introducing Meta Audience Network: new name, same partnership with publishers,” *Meta Audience Network*, November 12, 2021, available at <https://www.facebook.com/audiencenetwork/resources/blog/introducing-meta-audience-network>.

<sup>161</sup> Song Qian, “Introducing Facebook’s Audience Network,” *Meta*, April 30, 2014, available at <https://developers.facebook.com/blog/post/2014/04/30/audience-network/>; [REDACTED]

<sup>162</sup> Alex Spencer, “Facebook Opens Up Audience Network Header Bidding,” *Sonobi*, March 30, 2017, available at <https://sonobi.com/press-release/facebook-opens-audience-network-header-bidding/> (“Facebook has opened up Audience Network, the third-party ad network it introduced in 2014, to mobile web publishers.”); Josh Constine, “Facebook Opens Its Mobile Ad ‘Audience Network’ To All Advertisers And Apps,” *TechCrunch*, October 7, 2014, available at <https://techcrunch.com/2014/10/07/facebook-audience-network-ads/> (“After announcing its mobile ad network at f8 in April, Facebook today officially launched ‘Audience Network’ and started letting any advertiser buy any third-party app host ads powered by its targeting data.”).

<sup>163</sup> GOOG-DOJ-09183023 at 029.

<sup>164</sup> GOOG-DOJ-09183023 at 029.



b. TikTok

69. TikTok was launched in 2016 by the Chinese company ByteDance as a video-sharing social media platform.<sup>165</sup> In January 2019, TikTok formed an ad unit.<sup>166</sup> Later in 2019, TikTok introduced paid advertising to the platform, allowing advertisers to reach their desired audiences by connecting and engaging with content creators on TikTok.<sup>167</sup> TikTok quickly became “the third-largest social media platform and fastest growing digital ads player ever.”<sup>168</sup> Since 2020, TikTok’s advertising business has “grown around 50% year over year,” outpacing the revenue growth experienced by Google and Facebook in their early years.<sup>169</sup> Given TikTok’s growth, Google has recognized TikTok as a significant new threat to its Display business.<sup>170</sup> **Figure 13** shows the growth of TikTok’s display ad revenue over time, all of which is derived from mobile advertising.

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<sup>165</sup> Joe Tidy, and Sophia Smith Galer, “TikTok: The story of a social media giant,” *BBC News*, August 5, 2020, available at <https://www.bbc.com/news/technology-53640724>.

<sup>166</sup> “TikTok is quietly testing ads,” *Digiday*, January 29, 2019, available at <https://digiday.com/marketing/tiktok-quietly-testing-ads/>.

<sup>167</sup> Blake Chandlee, “Understanding our policies around paid ads,” *TikTok*, October 3, 2019, available at <https://newsroom.tiktok.com/en-us/understanding-our-policies-around-paid-ads>.

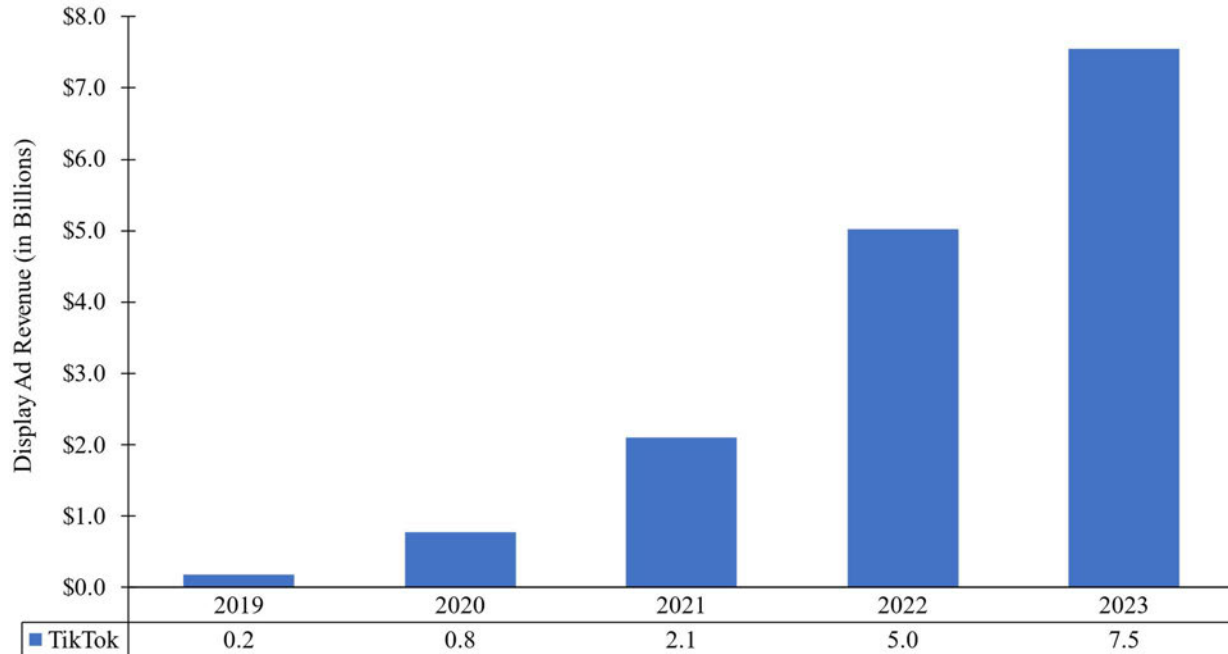
<sup>168</sup> GOOG-AT-MDL-007017426 at 438; GOOG-AT-MDL-013435568 at 587 (“TikTok is leveraging its consumer growth to scale an ambitious advertising business with the fastest ever growth”).

<sup>169</sup> Seb Joseph, and Krystal Scanlon, “Ad spending on TikTok defies advertising slowdown,” *Digiday*, January 17, 2023, available at <https://digiday.com/marketing/ad-spending-on-tiktok-defies-advertising-slowdown/>; GOOG-AT-MDL-013435568 at 575 (“TikTok’s goal of \$12B rev outpaces Google & Facebook’s hyper-growth phases”).

<sup>170</sup> GOOG-AT-MDL-009766884 at 889, 891, 903, 920.

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**Figure 13. TikTok’s Display Ad Revenue in the U.S., 2019-2023**



**Notes:**

[1] According to eMarketer, all of TikTok’s digital ad revenue is derived from mobile display advertising, which includes advertising that appears on mobile phones and tablets.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

70. In June 2020, TikTok launched a self-service platform for advertisers to create, manage, and measure their ad campaigns.<sup>171</sup> In July 2020, TikTok introduced TikTok Ads Manager,<sup>172</sup> which allows advertisers to target audiences based on demographics, interests, online behaviors,

<sup>171</sup> “Introducing TikTok For Business,” *TikTok*, October 26, 2020, available at <https://newsroom.tiktok.com/en-us/tiktok-business/>; Sarah Perez, “TikTok launches TikTok For Business for marketers, takes on Snapchat with new AR ads,” *TechCrunch*, June 25, 2020, available at <https://techcrunch.com/2020/06/25/tiktok-launches-tiktok-for-business-for-marketers-takes-on-snapchat-with-new-ar-ads/>.

<sup>172</sup> “TikTok For Business Launches New Solutions to Help Small Businesses Connect and Grow with the TikTok Community,” *TikTok*, July 8, 2020, available at <https://newsroom.tiktok.com/en-us/tiktok-for-business-launches-new-smb-solutions/>; “About TikTok Ads Manager,” *TikTok: Business Help Center*, May 2024, available at <https://ads.tiktok.com/help/article/tiktok-ads-manager-intro?lang=en>; Allison Schiff, “TikTok Launches Self-Serve Ad Platform With An Eye On Enticing SMBs,” *AdExchanger*, July 8, 2020, available at <https://www.adexchanger.com/platforms/tiktok-launches-self-serve-ad-platform-with-an-eye-on-enticing-smbs/>; Megan Graham, “TikTok’s new offering for small advertisers could help it lure them from Facebook,” *CNBC*, July 8, 2020, available at <https://www.cnn.com/2020/07/08/tiktok-opens-up-self-serve-ad-platform-gives-ad-credits-to-smbs.html>.

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and the type of mobile devices used to access TikTok.<sup>173</sup> TikTok has continued to introduce additional targeting and measurement tools.<sup>174</sup> Since its launch, TikTok has also offered several display ad formats on its platform.<sup>175</sup>

71. The number of TikTok users in the U.S. has grown to over 100 million in 2023.<sup>176</sup> Roughly 58% of teens between 13 and 17 visit TikTok at least once a day.<sup>177</sup> Average TikTok users spend an average of approximately 58 minutes on the app per day.<sup>178</sup> One of the several uses of TikTok is consumption of news, with 14% of all U.S. adults reporting that they

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<sup>173</sup> “About Ad Targeting,” *TikTok: Business Help Center*, available at <https://ads.tiktok.com/help/article/ad-targeting?lang=en>.

<sup>174</sup> “Introducing TikTok brand lift study to measure the moments that matter most,” *TikTok*, June 22, 2021, available at <https://newsroom.tiktok.com/en-us/introducing-tiktok-brand-lift-study-to-measure-the-moments-that-matter-most>; “About TikTok Brand Lift Studies,” *TikTok: Business Help Center*, October 2023, available at <https://ads.tiktok.com/help/article/tiktok-brand-lift-studies?lang=en> (“When you run a TikTok Brand Lift Study, we will create two randomized groups from a portion of your campaign’s target audience: an Exposed Group that sees your promoted content and a Control Group that does not. We will then use a combination of polling and statistical techniques to measure the difference in key performance indicators, like awareness and ad recall, between the two groups, which can be attributed to your advertising.”); “Introducing Video Insights: Data to fuel your ad creative,” *TikTok for Business*, May 4, 2023, available at <https://www.tiktok.com/business/en-US/blog/video-insights-ad-creative-data>.

<sup>175</sup> At the time of the launch, the platform offered several display ad formats, including TopView (the first video ad shown to users when they opened the TikTok app), Brand Takeovers (three to five-second image or video ads appearing at the launch of the TikTok app), In-Feed Videos (video ads placed in the user’s main feed), Hashtag Challenges (ads prompting TikTok users to create content around a hashtag), and Branded Effects (ads integrated as branded stickers, filters, or effects into users’ videos). See Sarah Perez, “TikTok launches TikTok For Business for marketers, takes on Snapchat with new AR ads,” *TechCrunch*, June 25, 2020, available at <https://techcrunch.com/2020/06/25/tiktok-launches-tiktok-for-business-for-marketers-takes-on-snapchat-with-new-ar-ads/>. In subsequent years, TikTok added new ad formats, such as shoppable video ads, which make it easy for users to discover and purchase products all within the TikTok app. See “TikTok World: Introducing Shopping Ads,” *TikTok for Business*, October 13, 2022, available at <https://www.tiktok.com/business/en-US/blog/tiktok-world-shopping-ads>; Aisha Malik, “TikTok launches new ad solutions with smarter targeting and amplified product discovery,” *TechCrunch*, August 17, 2022, available at <https://techcrunch.com/2022/08/17/tiktok-launches-new-ad-solutions-with-smarter-targeting-and-amplified-product-discovery/>.

<sup>176</sup> Laura Ceci, “Number of TikTok users in the United States from 2023 to 2027,” *Statista*, May 22, 2024, available at <https://www.statista.com/statistics/1100836/number-of-us-tiktok-users/> (“In 2023, social video app TikTok had approximately 102 million users in the United States.”).

<sup>177</sup> Monica Anderson, Michelle Faverio, and Jeffrey Gottfried, “Teens, Social Media and Technology 2023,” *Pew Research Center*, December 11, 2023, available at <https://www.pewresearch.org/internet/2023/12/11/teens-social-media-and-technology-2023/>.

<sup>178</sup> Shubham Singh, “TikTok User Statistics 2024 (Global Data),” *DemandSage*, April 29, 2024, available at <https://www.demandsage.com/tiktok-user-statistics/> (“TikTok users spend 58 minutes and 24 seconds on the app daily as of 2024.”).

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“regularly get news from TikTok,” and around 32% of adults under 30 regularly getting news from there.<sup>179</sup>

c. X

72. X (previously Twitter<sup>180</sup>) was launched in 2006 as an online communication platform for short text messaging, called tweets, between groups.<sup>181</sup> **Figure 14** shows the growth of X’s display ad revenue over time.

73. X offers a wide variety of display ad formats to advertisers for their ad campaigns, including links to mobile apps, in addition to other display ad formats such as images, audio, and videos.<sup>182</sup> X has also developed measurement tools that help advertisers refine their targeting strategies to improve the overall effectiveness of their ad campaigns.<sup>183</sup> X, and in particular its self-service platform, is a competitive threat to Google Ads.<sup>184</sup>

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<sup>179</sup> Katerina Eva Matsa, “More Americans are getting news on TikTok, bucking the trend seen on most other social media sites,” *Pew Research Center*, November 15, 2023, available at <https://www.pewresearch.org/short-reads/2023/11/15/more-americans-are-getting-news-on-tiktok-bucking-the-trend-seen-on-most-other-social-media-sites/>.

<sup>180</sup> Irina Ivanova, “Twitter is now X. Here’s what that means,” *CBS News*, July 31, 2023, available at <https://www.cbsnews.com/news/twitter-rebrand-x-name-change-elon-musk-what-it-means/>.

<sup>181</sup> “This Day In History: 2006: Twitter Launches,” *HISTORY*, available at <https://www.history.com/this-day-in-history/twitter-launches>.

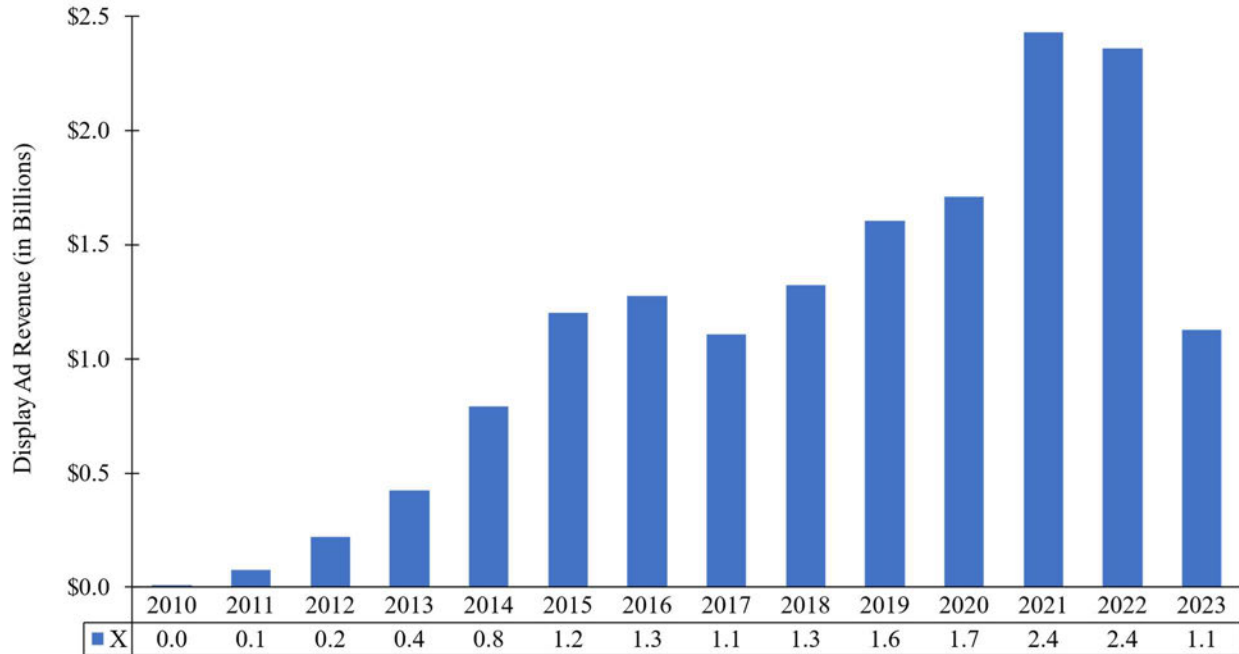
<sup>182</sup> “Create an app re-engagements campaign,” *X Business*, available at <https://business.x.com/en/help/campaign-setup/create-an-app-reengagement-campaign.html>; “X Ad Formats,” *X Business*, available at <https://business.x.com/en/advertising/formats.html>.

<sup>183</sup> “X Ads measurement,” *X Business*, available at <https://business.x.com/en/advertising/measurement.html>.

<sup>184</sup> GOOG-DOJ-04602586 at 592-593 (Google’s self-serve platform competes with those offered by Facebook, Pinterest, Amazon, LinkedIn, Spotify, Twitter, Reddit, and Snapchat); GOOG-AT-MDL-009766884 at 889 (identifying Twitter as an “additional threat[ ]”); GOOG-DOJ-04735025 at 025 (“If you ask advertisers where they are promoting their content marketing assets, the answer always comes back, Facebook, Twitter, Outbrain and Taboola (sometimes Sharethrough). This type of campaign (content marketing) is usually seen as a mid-funnel, consideration focused objective and not something that Google excels in.”).

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**Figure 14. X's Display Ad Revenue in the U.S., 2010-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices for all display ad formats.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

74. Starting in 2012, X's mobile ad products have contributed the majority of its ad revenue, as X users have been more active on mobile devices than on desktop devices.<sup>185</sup> In 2013, X acquired MoPub (which it later sold to AppLovin), a mobile-focused ad platform, which allows mobile app publishers to manage their advertising inventory and optimize multiple sources of ads on a single platform, including direct sales, ad networks, and real-time bidding (RTB) ad

<sup>185</sup> “Promoted Products: now more mobile,” *X Blog*, February 28, 2012, available at [https://blog.x.com/en\\_us/a/2012/promoted-products-now-more-mobile](https://blog.x.com/en_us/a/2012/promoted-products-now-more-mobile); Shira Ovide, “Twitter’s Mobile Ads Begin to Click,” *The Wall Street Journal*, June 28, 2012, available at <https://www.wsj.com/articles/SB10001424052702304458604577491170573156612>.

buying.<sup>186</sup> Also in 2013, X introduced several ad products, including a self-service platform that allows advertisers to target users more precisely than before.<sup>187</sup>

***3. Retailers attract advertiser spending through their self-service platforms, pulling spending from “open web” advertising.***

75. As with social media properties, by artificially delineating “open web display advertising” as a category, Plaintiffs’ experts fail to recognize the growing importance of retail platforms for advertisers as consumers increasingly transact online with them.<sup>188</sup> Through platforms run by Amazon, Walmart, eBay, and others, advertisers are able to reach a significant audience base. In **Section IV.B** below, I provide evidence that advertisers reallocate spending between “open web” and retail platforms and other websites and apps based on performance.

76. **Figure 15** depicts the surging display ad spending with Amazon, Walmart, and other retail media in the U.S.:

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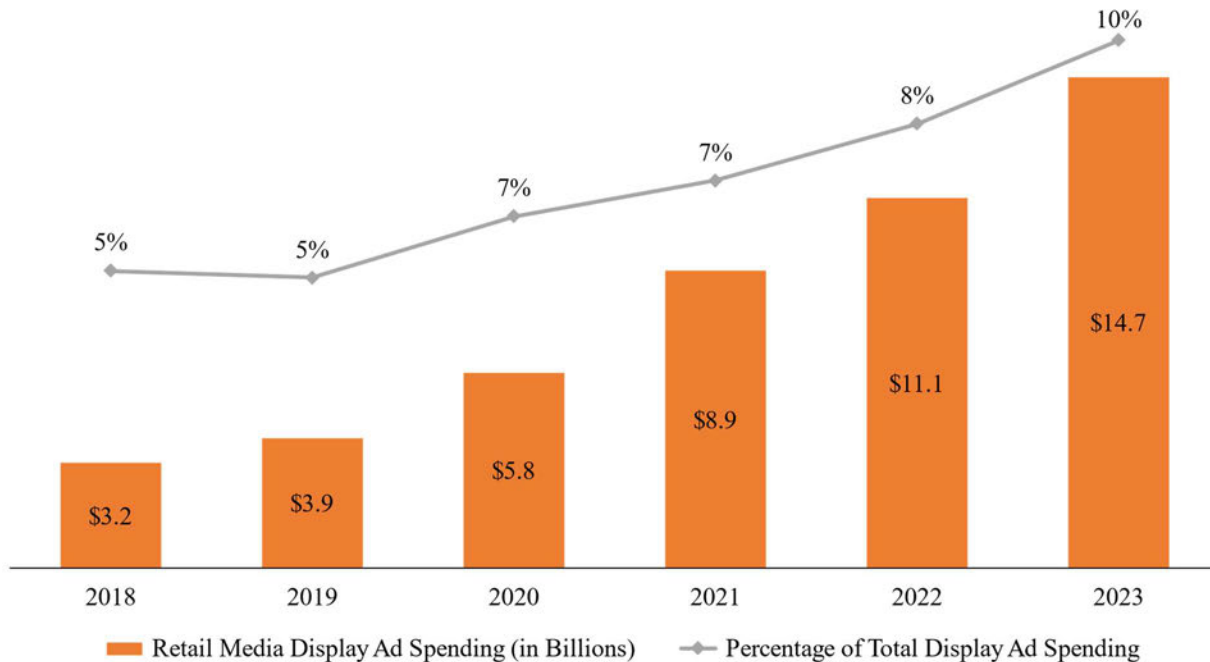
<sup>186</sup> “Driving mobile advertising forward: welcoming MoPub to the Flock,” *X Blog*, September 9, 2013, available at [https://blog.x.com/official/en\\_us/a/2013/driving-mobile-advertising-forward-welcoming-mopub-to-the-flock.html](https://blog.x.com/official/en_us/a/2013/driving-mobile-advertising-forward-welcoming-mopub-to-the-flock.html); Sarah Perez, “Twitter completes sale of MoPub to AppLovin for \$1.05 billion,” *TechCrunch*, January 3, 2022, available at <https://techcrunch.com/2022/01/03/twitter-completes-sale-of-mopub-to-applovin-for-1-05-billion/>.

<sup>187</sup> Shara Tibken, “Twitter ads now available for all U.S. users,” *CNET*, April 30, 2013, available at <https://www.cnet.com/tech/services-and-software/twitter-ads-now-available-for-all-u-s-users/>.

<sup>188</sup> For example, Professor Gans identifies Amazon as having its own ad platforms, but does not discuss growth of transactions on this platform over time. *See* Gans Report, ¶ 161 (“As depicted below in Figure 3, some publishers, such as Facebook and Amazon, are Walled Garden Publishers (WGPs).”), ¶ 168 (“WGPs (e.g., Facebook, Snapchat, Amazon, etc.) typically built their own in-house tools to sell ‘directly to the advertisers’”). Dr. Chandler also identifies Amazon but does not discuss growth of transactions over time. *See* Chandler Report, ¶ 31(8) (“Walled Gardens in digital advertising refer to closed ecosystems where the platform owner controls the ad inventory and data. Prominent examples include Google, Facebook, and Amazon.”).

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**Figure 15. Retail Media Display Ad Spending in the U.S., 2018-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices for all display ad formats.

[2] Retail media advertising refers to digital advertising that appears on websites or apps that are primarily engaged in retail e-commerce or is bought through a retailer's media network or DSP; examples of websites or apps primarily engaged in retail e-commerce include Amazon, Walmart, and eBay; examples of retail media networks include Amazon's DSP and Etsy's Offsite Ads; includes ads purchased through retail media networks that may not appear on e-commerce sites or apps.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab "US Ad Spend Metrics").

77. In the late 2010s, U.S. retailers invested in their own ad tech capabilities, drawing more advertiser spending through their self-service platforms. Around 2012, Amazon began to invest in its own ad tech capabilities.<sup>189</sup> Many other retailers followed over the subsequent years,

<sup>189</sup> Alistair Barr, and Jennifer Saba, "Sleeping ad giant Amazon finally stirs," *Reuters*, April 23, 2013, available at <https://www.reuters.com/article/us-amazon-advertising/analysis-sleeping-ad-giant-amazon-finally-stirs-idINBRE93N06E20130424>.



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including Walmart,<sup>190</sup> eBay,<sup>191</sup> Target,<sup>192</sup> Dollar General,<sup>193</sup> and Albertsons.<sup>194</sup> One aspect of this investment involved developing data-driven solutions (using first-party data, *i.e.*, data provided by or collected from consumers,<sup>195</sup> such as consumers' purchase history) to help advertisers improve their marketing efforts and reach their target audiences more effectively.<sup>196</sup>

78. Amazon's advertising business grew rapidly, making nearly \$38 billion in revenue in 2022, \$12.1 billion in the third quarter of 2023 (up from \$9.5 billion in Q3 2022), and was expected to account for 12.4% of all U.S. digital advertising in 2023.<sup>197</sup> Indeed, Google's business documents noted that "Amazon was a "core competitive threat[]" that was growing faster than Google."<sup>198</sup> **Figure 16** illustrates the rapid growth of Amazon's display ad revenue, especially from 2018 onwards (*i.e.*, since the introduction of Amazon Advertising):

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<sup>190</sup> Kelly Liyakasa, "Walmart: The New Media Agency," *AdExchanger*, July 11, 2014, available at <https://www.adexchanger.com/ecommerce-2/walmart-the-new-media-agency/>.

<sup>191</sup> "Shopping.com Re-Launches as the eBay Commerce Network," *eBay*, April 2, 2013, available at <https://www.ebayinc.com/stories/press-room/au/shopping-com-re-launches-as-the-ebay-commerce-network/>.

<sup>192</sup> "Meet Roundel, Target's Reimagined Media Company," *Target Corporate*, May 2, 2019, available at <https://corporate.target.com/article/2019/05/roundel>; "Solutions designed for connection." *Roundel*, available at <https://roundel.com/what-we-offer/>.

<sup>193</sup> "Dollar General Introduces Evolution of Retail Media Network, DGMN," *Dollar General Newsroom*, June 7, 2022, available at <https://newscenter.dollargeneral.com/news/dollar-general-introduces-evolution-of-retail-media-network-dgmn/963ade23-a9fd-4d22-8135-afc201f13a44>.

<sup>194</sup> Lauren Hirsch, "Albertsons is going to help companies test just how effective their digital ads are," *CNBC*, January 25, 2018, available at <https://www.cnn.com/2018/01/25/albertsons-gets-into-the-media-business-with-new-product-for-consumer-brands-.html>.

<sup>195</sup> Sophia Bernazzani Barron, "A Basic Definition of First Party, Second Party, & Third Party Data," *HubSpot*, October 21, 2022, available at <https://blog.hubspot.com/service/first-party-data> ("First party data is data your company has collected directly from your audience, whether customer, site visitors, or social media followers.").

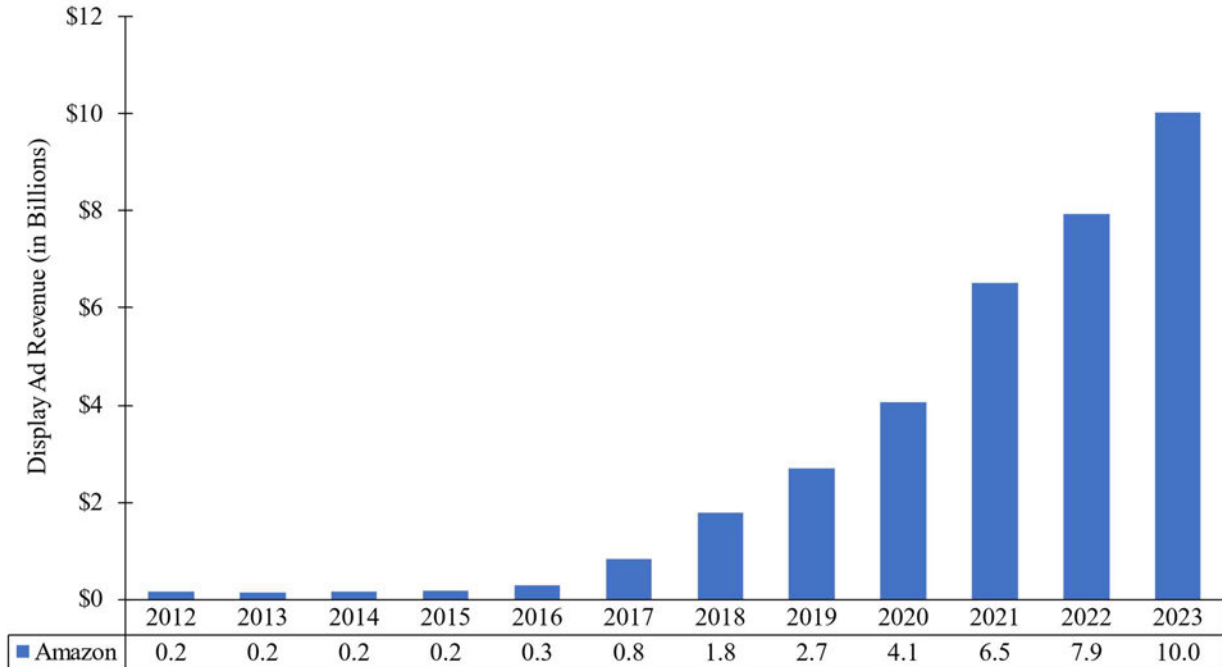
<sup>196</sup> Kelly Liyakasa, "Behind eBay's Ads Business: We Think Our User Data Is 'Pretty Important,'" *AdExchanger*, February 17, 2014, available at <https://www.adexchanger.com/online-advertising/behind-ebays-ads-business-we-think-our-user-data-is-pretty-important/>; Derek Slager, "The Evolution Of Retail Media Networks: The First-Party Data Revolution," *Forbes*, October 24, 2023, available at <https://www.forbes.com/sites/forbestechcouncil/2023/10/24/the-evolution-of-retail-media-networks-the-first-party-data-revolution/>.

<sup>197</sup> "2022 Amazon Annual Report," *Amazon*, available at [https://s2.q4cdn.com/299287126/files/doc\\_financials/2023/ar/Amazon-2022-Annual-Report.pdf](https://s2.q4cdn.com/299287126/files/doc_financials/2023/ar/Amazon-2022-Annual-Report.pdf), at p. 67; "Amazon.com Announces Third Quarter Results," *Amazon*, October 26, 2023, available at <https://ir.aboutamazon.com/news-release/news-release-details/2023/Amazon.com-Announces-Third-Quarter-Results/default.aspx>; Hope King, "Amazon sees huge potential in ads business as AWS growth flattens," *Axios*, April 27, 2023, available at <https://www.axios.com/2023/04/28/amazon-earnings-aws-retail-ads>.

<sup>198</sup> GOOG-AT-MDL-009766884 at 889, 891.

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**Figure 16. Amazon’s Display Ad Revenue in the U.S., 2012-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices for all display ad formats.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

79. “Amazon Advertising” provides ad products for different advertising needs, including display ads.<sup>199</sup> Amazon’s display advertising offering includes a self-service platform called Amazon Ads, which serves ads both on Amazon owned-and-operated properties and third-party publisher properties,<sup>200</sup> and a demand-side platform called Amazon DSP,<sup>201</sup> which allows

<sup>199</sup> “Amazon Advertising: Announcing a single unified brand,” *Amazon Ads*, September 5, 2018, available at <https://advertising.amazon.com/blog/amazon-advertising-simplified>. Unlike AAP and AMS, AMG is not an ad product but rather Amazon’s in-house team that works closely with advertisers and agencies to sell ad products. See Yuyu Chen, “Know AAP from AMG and AMS: How Amazon’s major ad offerings work,” *Digiday*, December 13, 2017, available at <https://digiday.com/marketing/know-aap-amg-ams-amazons-major-ad-offerings-work/>.

<sup>200</sup> “Sponsored Display,” *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/sponsored-display>.

<sup>201</sup> “Amazon DSP: Your brand in new places.” *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/amazon-dsp>; “Amazon Advertising: Announcing a single unified brand,” *Amazon Ads*, September 5, 2018, available at <https://advertising.amazon.com/blog/amazon-advertising-simplified>.

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advertisers to programmatically reach their audiences both on Amazon owned-and-operated properties and third-party publisher properties.<sup>202</sup> Amazon Advertising also provides advertisers with a variety of measurement solutions to help advertisers gauge the effectiveness of their ad campaigns.<sup>203</sup> Amazon’s buy-side tools compete directly with both Google Ads and DV360, with Google’s internal documents recognizing that publishers diverted advertising spending to Amazon’s owned-and-operated inventory.<sup>204</sup>

80. In 2021, Amazon began providing a cloud-based environment in which advertisers could analyze their own first-party data alongside Amazon’s data to generate aggregate reports about

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<sup>202</sup> Like Amazon Ads, Google Ads provides a self-service platform. See Irina Kovalenko, “Exploring the Benefits of Self-Serve Ad Networks: 9 Examples,” *SmartyAds*, May 22, 2023, available at <https://smartyads.com/blog/best-self-serve-ad-networks/> (“Google Ads is one of the most popular self-serve advertising platforms, offering various advertising options, including search, display, video, and app ads.”); Sukanya VS, “Your Guide to The Best Self-Serve Advertising Platforms,” *PubScale*, November 9, 2023, available at <https://pubscale.com/blog/best-self-serve-advertising-platforms>. Like Amazon DSP, Google DV360 is a DSP. See Mike Sweeney, and Paulina Zawislak, “Top Demand-Side Platform (DSP) Companies [Updated in 2024],” *Clearcode*, January 31, 2024, available at <https://clearcode.cc/blog/top-demand-side-platforms/>.

<sup>203</sup> “Amazon Advertising: Announcing a single unified brand,” *Amazon Ads*, September 5, 2018, available at <https://advertising.amazon.com/blog/amazon-advertising-simplified>.

<sup>204</sup> GOOG-DOJ-05526944 at 945 (identifying Amazon as “hav[ing] diverted significant spend from 3rd party publishers to their O&O inventory. [...] These shifts are increasing pressure on our publishers to drive more revenue from their inventory and creating new openings for competitors”); see also “Amazon Pulls Ahead In Latest Advertiser Perceptions DSP Report,” *Advertiser Perceptions*, November 26, 2018, available at <https://www.advertiserperceptions.com/amazon-pulls-ahead-in-latest-advertiser-perceptions-dsp-report/> (“Based on interviews with 483 advertisers in July, the new DSP Report from Advertiser Perceptions shows Amazon pulling ahead in usage, with 41% of advertisers using the Amazon Advertising Platform, while 35% use Doubleclick Bid Manager and 26% use The Trade Desk.”); [REDACTED]; [REDACTED]; [REDACTED]”); GOOG-AT-MDL-007210197 at 197-198 (listing The Trade Desk, Roku, Verizon, and Amazon as competitors ahead of DV360 in 3P CTV, and noting that “Amazon & Roku also leverage logged in user data for audience matching & measurement.”); GOOG-AT-MDL-009766884 at 889, 891, 920 (Amazon is one of Google’s “core competitive threats” whose display and video business has grown faster than Google’s in recent years and to whom “Google continues to lose share of digital wallet”).

how their marketing performs across search, display, video, and audio media channels (both on- and off-Amazon).<sup>205, 206</sup>

81. In addition to these tools for advertisers, Amazon has developed products for publishers as well under its Amazon Publisher Services umbrella. These include Unified Ad Marketplace (UAM) and Transparent Ad Marketplace (TAM), two server-side header bidding solutions.<sup>207</sup>

**Section VII.I** discusses these products in greater detail.

82. In 2021, Walmart announced the creation of a self-service platform for advertisers to manage display campaigns on Walmart.com and other websites.<sup>208</sup> Later in 2021, Walmart introduced a demand-side platform (DSP), built in partnership with The Trade Desk.<sup>209</sup> Walmart's DSP allows advertisers to reach targeted audiences by leveraging Walmart's first-party omnichannel data, acquired from online and offline sales. As part of the partnership with The Trade Desk, advertisers on Walmart can access The Trade Desk's inventory across multiple display channels.<sup>210</sup>

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<sup>205</sup> Emmeline Toyama, and Alan Lewis, "Introducing Amazon Marketing Cloud (beta)," *Amazon Ads*, January 4, 2021, available at <https://advertising.amazon.com/blog/introducing-amazon-marketing-cloud>; James Hercher, "After A Two-Year Quiet Phase, Amazon's Data Clean Room Service Enters The Market," *AdExchanger*, October 26, 2021, available at <https://www.adexchanger.com/online-advertising/after-a-two-year-quiet-phase-amazons-data-clean-room-service-enters-the-market/>.

<sup>206</sup> James Hercher, "Amazon Is Leaning On Its Data Clean Room To Spur Ad Tech Growth," *AdExchanger*, October 26, 2022, available at <https://www.adexchanger.com/commerce/amazon-is-leaning-on-its-data-clean-room-to-spur-ad-tech-growth/>.

In 2023, Amazon's display ad revenue was \$10.0 billion, which accounted for nearly 30% of its total digital ad revenue of \$33.6 billion. *See* eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab "US Ad Spend Metrics," Rows 204, 331).

<sup>207</sup> Brock Munro, "Amazon Publisher Services Guide," *Publifi*, June 28, 2024, available at <https://www.publifi.com/blog/amazon-publisher-services>.

<sup>208</sup> "Walmart Connect Ramps Up On-Site Offerings with Upcoming Launch of Display Self-Serve Platform and Acquisition of Thunder Advertising Technology," *Walmart*, February 4, 2021, available at <https://corporate.walmart.com/newsroom/2021/02/04/walmart-connect-ramps-up-on-site-offerings-with-upcoming-launch-of-display-self-serve-platform-and-acquisition-of-thunder-advertising-technology>; "Inspire Walmart customers throughout their journey," *Walmart Connect*, available at <https://www.walmartconnect.com/display>.

<sup>209</sup> Rich Lehrfeld, "Walmart Connect Launches Its New Demand-Side Platform, Walmart DSP, To Expand Its Off-Site Media Offerings at Scale," *Walmart*, August 25, 2021, available at <https://corporate.walmart.com/news/2021/08/25/walmart-connect-launches-its-new-demand-side-platform-walmart-dsp-to-expand-its-off-site-media-offerings-at-scale>.

<sup>210</sup> Rich Lehrfeld, "Walmart Connect Launches Its New Demand-Side Platform, Walmart DSP, To Expand Its Off-Site Media Offerings at Scale," *Walmart*, August 25, 2021, available at

**4. Connected TV companies have emerged as popular properties for advertisers who reallocate funds from web advertising.**

83. Plaintiffs’ experts treat instream video advertisements, including those on connected TV (CTV),<sup>211</sup> as distinct from “open web display advertising.”<sup>212</sup> In **Section IV.B** below, I provide evidence that advertisers reallocate spending between “open web” and streaming video and other display ads based on performance. For example, [REDACTED]

[REDACTED]<sup>213</sup> The growing popularity of CTV among users in the late 2000s and early 2010s set the stage for CTV advertising to emerge around 2014-2015.<sup>214</sup> CTV providers afforded advertisers the ability to reach their desired audiences through advertising on smart TVs, computers, mobile devices, and gaming consoles. Unlike linear (traditional) television advertising, CTV advertising allows advertisers to target users based on granular data regarding a user’s demographics, interests, viewing habits, and other metrics, similar to other formats of display advertising.<sup>215</sup> For example, [REDACTED]

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<https://corporate.walmart.com/news/2021/08/25/walmart-connect-launches-its-new-demand-side-platform-walmart-dsp-to-expand-its-off-site-media-offerings-at-scale>.

<sup>211</sup> Connected TV refers to content streamed through internet-connected devices, while linear TV is traditional broadcast television with a set programming schedule.

<sup>212</sup> Gans Report, Section III.B.2; Chandler Report, Sections V.A, V.B, and V.C. Professor Gans identifies Hulu and Disney as examples of large publishers in video advertising, but does not discuss growth of transactions on these platforms over time. *See* Gans Report, Footnote 142 (“Examples of large publishers specialized in video advertising include Hulu and Disney.”).

<sup>213</sup> [REDACTED]

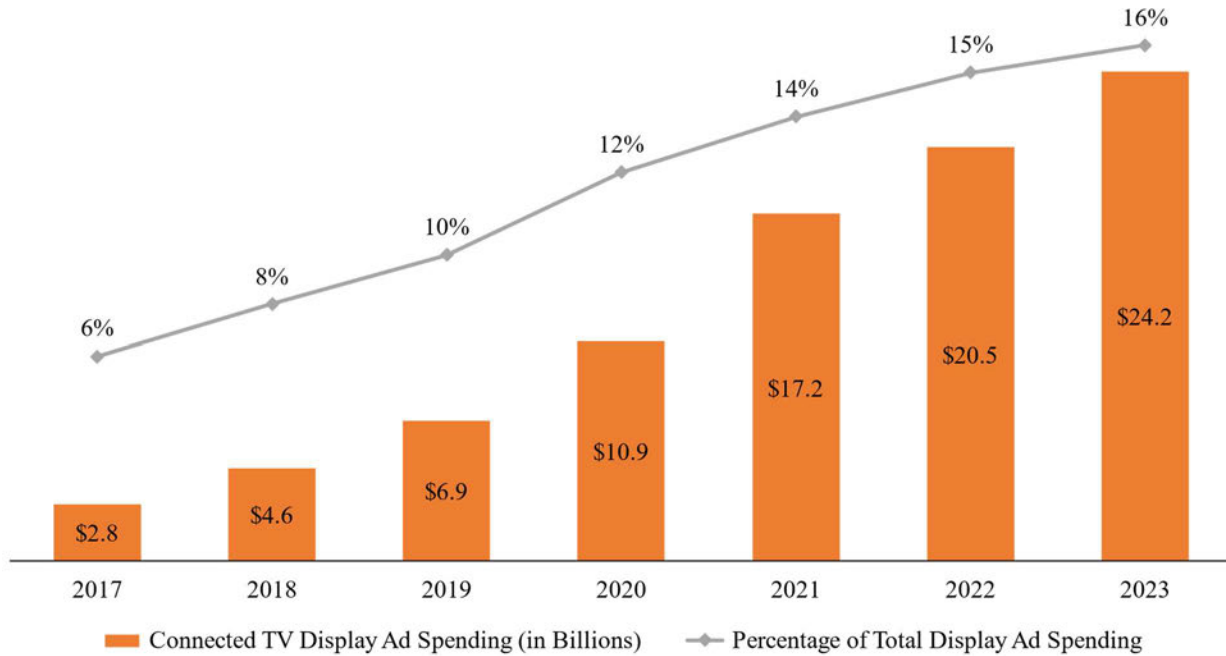
<sup>214</sup> Don Reisinger, “Study: 123 million connected TVs to ship in 2014,” *CNET*, April 25, 2011, available at <https://www.cnet.com/home/smart-home/study-123-million-connected-tvs-to-ship-in-2014/>.

<sup>215</sup> The MNTN Team, “What Is Connected TV? How CTV Advertising Works (2024),” *MNTN*, available at <https://mountain.com/blog/connected-tv-advertising/>.

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.<sup>216</sup> **Figure 17** depicts the surging display ad spending on Hulu, Roku, Netflix, and other CTV platforms in the U.S.:

**Figure 17. CTV Display Ad Spending in the U.S., 2017-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on CTV devices.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

[REDACTED]

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84. Several CTV providers, including Hulu, Roku, and YouTube, have been selling ad space on their properties for many years.<sup>217</sup> More recently, Peacock,<sup>218</sup> Max (formerly HBO Max),<sup>219</sup> Paramount+,<sup>220</sup> Netflix,<sup>221</sup> Amazon,<sup>222</sup> and Disney+<sup>223</sup> also launched ad-supported tiers and invested in self-service advertising capabilities, making their properties alternatives for advertisers looking to reach targeted audiences. Various ad tech firms, including The Trade Desk, Magnite, and Comcast, derive revenue (and have the potential to derive very large revenues) from the significant growth in CTV advertising.<sup>224</sup> Plaintiffs' experts largely ignore these developments and largely ignore the significance of firms like Disney (which owns Hulu), Roku, and Netflix in attracting spending from advertisers.

a. Hulu and Disney

85. Hulu was launched in 2007 as a website providing access to recent episodes of live TV shows, with ads interspersed.<sup>225</sup> Initially, Hulu's services were available free of charge, but in subsequent years, Hulu added access with various fee levels, including an ad-free option with a

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<sup>217</sup> Amanda Walgrove, "The Explosive Growth of Online Video, in 5 Charts," *Contently*, available at <https://contently.com/2015/07/06/the-explosive-growth-of-online-video-in-5-charts/>.

<sup>218</sup> "NBCUniversal Unveils Peacock, A Free Premium Ad-Supported Streaming Service With Subscription Tiers," *Comcast*, January 16, 2020, available at <https://www.cmcsa.com/news-releases/news-release-details/nbcuniversal-unveils-peacock-free-premium-ad-supported-streaming>.

<sup>219</sup> Todd Spangler, "HBO Max With Ads Launches: What's Different in the \$10 Monthly Plan," *Variety*, June 2, 2021, available at <https://variety.com/2021/digital/news/hbo-max-with-ads-launch-pricing-1234986422/>.

<sup>220</sup> Todd Spangler, "Paramount Plus Cheaper Ad-Supported Plan Launches Next Week," *Variety*, June 3, 2021, available at <https://variety.com/2021/digital/news/paramount-plus-pricing-ad-supported-plan-1234987979/>.

<sup>221</sup> Lauren Forristal, "Netflix's ad-supported plan is finally here," *TechCrunch*, November 3, 2022, available at <https://techcrunch.com/2022/11/03/netflixs-ad-supported-plan-is-finally-here/>.

<sup>222</sup> Todd Spangler, "Amazon Prime Video's Move to Steamroll into Ads Could Generate More Than \$3 Billion This Year: A Disruptive Force," *Variety*, January 26, 2024, available at <https://variety.com/2024/tv/news/amazon-prime-video-advertising-revenue-forecast-1235888805/>.

<sup>223</sup> "Ad-Supported Disney+ Plan Now Available In The U.S. With More Than 100 Advertisers Across All Major Categories At Launch," *The Walt Disney Company*, December 8, 2022, available at <https://thewaltdisneycompany.com/ad-supported-disney-plan-now-available-in-the-u-s-with-more-than-100-advertisers-across-all-major-categories-at-launch/>.

<sup>224</sup> Dave Morgan, "We Pick the Winners of the \$100 Billion CTV Ad Market," *Simulmedia*, July 22, 2021, available at <https://www.simulmedia.com/blog/we-pick-the-winners-of-the-coming-usd100-billion-ctv-ad-market>.

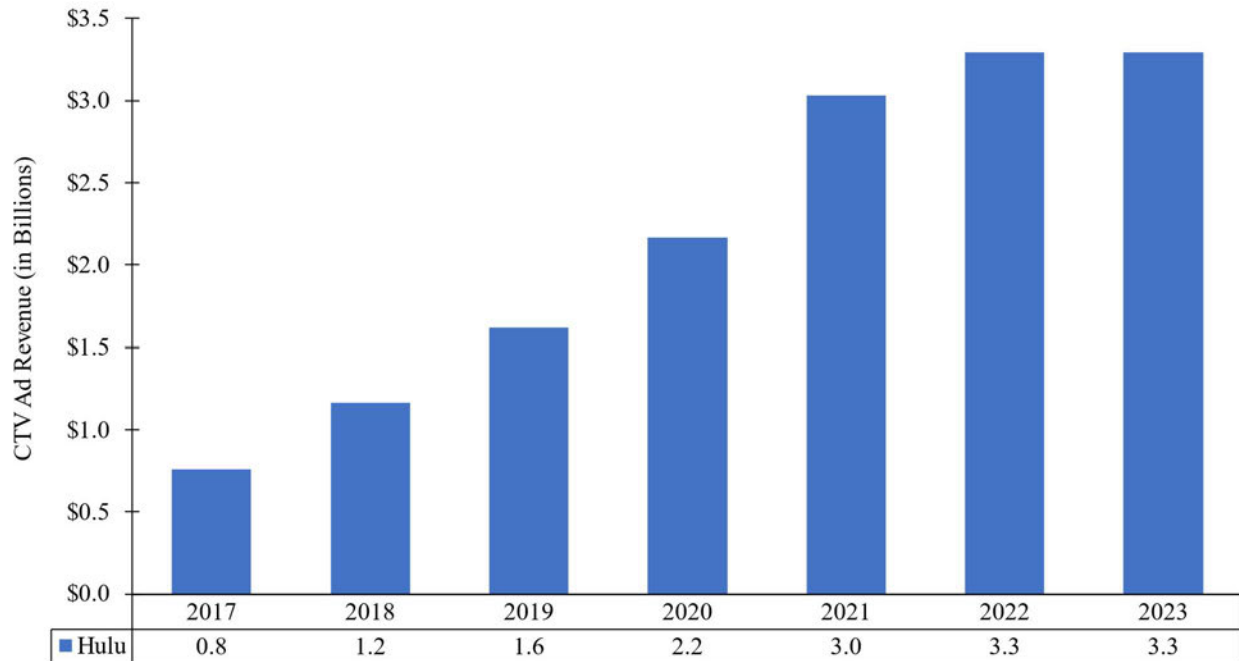
<sup>225</sup> Clayton Schuster, "Yes, Hulu Is Showing You That Same Ad Over and Over Again-And Here's Why It's Working," *Observer*, December 26, 2018, available at <https://observer.com/2018/12/hulu-advertisements-commercials-industry-tactics/>.



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higher subscription fee than ad-supported options.<sup>226</sup> **Figure 18** shows the growth of Hulu’s CTV ad revenue in the U.S., which more than quadrupled in five years, from less than \$1 billion in 2017 to more than \$3 billion by 2022.

**Figure 18. Hulu’s CTV Ad Revenue in the U.S., 2017-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on CTV devices.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

86. Hulu built and offered its own self-service platform for advertisers to use to buy ads on Hulu.<sup>227</sup> Hulu also developed and used its own, internal publisher ad server before it was

<sup>226</sup> Clayton Schuster, “Yes, Hulu Is Showing You That Same Ad Over and Over Again-And Here’s Why It’s Working,” *Observer*, December 26, 2018, available at <https://observer.com/2018/12/hulu-advertisements-commercials-industry-tactics/>.

<sup>227</sup> [REDACTED]  
[REDACTED]  
[REDACTED] Megan Graham, “Disney’s Hulu is trying to make it easier for small businesses to buy ads,” *CNBC*, July 15, 2020, available at <https://www.cnbc.com/2020/07/15/hulu-launches-self-serve-ad-platform-for-small-businesses.html>.

acquired by Disney.<sup>228</sup> Hulu used data-management services provided by Oracle to help advertisers combine their first-party data with Hulu’s demographic or viewer data and Oracle’s third-party data (data collected from users by Oracle while users are on websites and apps not owned by Hulu)<sup>229</sup> to make their ads more targeted.<sup>230</sup>

87. Hulu was acquired by Disney in May 2019.<sup>231</sup> [REDACTED]

[REDACTED]

[REDACTED]<sup>232, 233</sup> [REDACTED]

228

[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED] Sarah Perez, “Pluto TV, An Online Video Service Targeting Cord Cutters, Will Stream Hulu,” *TechCrunch*, July 1, 2015, available at <https://techcrunch.com/2015/07/01/pluto-tv-an-online-video-service-targeting-cord-cutters-will-soon-stream-hulu/> (“Hulu’s involvement with Pluto TV was mainly about making its web player a bit easier to embed on the Pluto TV website. There, users will be able to watch Hulu’s shows – as well as view the ads powered by Hulu’s ad server.”).

229 Sophia Bernazzani Barron, “A Basic Definition of First Party, Second Party, & Third Party Data,” *HubSpot*, October 21, 2022, available at <https://blog.hubspot.com/service/first-party-data> (“Third party data is any data collected by a business without any direct link to your business or audience.”).

230 Kelly Liyakasa, “Hulu Uncorks A Private Exchange,” *AdExchanger*, August 25, 2015, available at <https://www.adexchanger.com/digital-tv/hulu-uncorks-a-private-exchange/>.

231 “Disney reaches \$8.6 billion deal with Comcast to fully acquire Hulu,” *CBS News*, November 1, 2023, available at <https://www.cbsnews.com/news/disney-8-6-billion-dollar-deal-fully-acquire-hulu-from-comcast/>.

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[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

233

[REDACTED]

88. [REDACTED]

[REDACTED].<sup>237</sup> In 2023, Disney+ (streaming service provided by Disney<sup>238</sup>) alone had a total ad revenue of \$858.8 million and CTV ad revenue of \$702.5 million.<sup>239</sup>

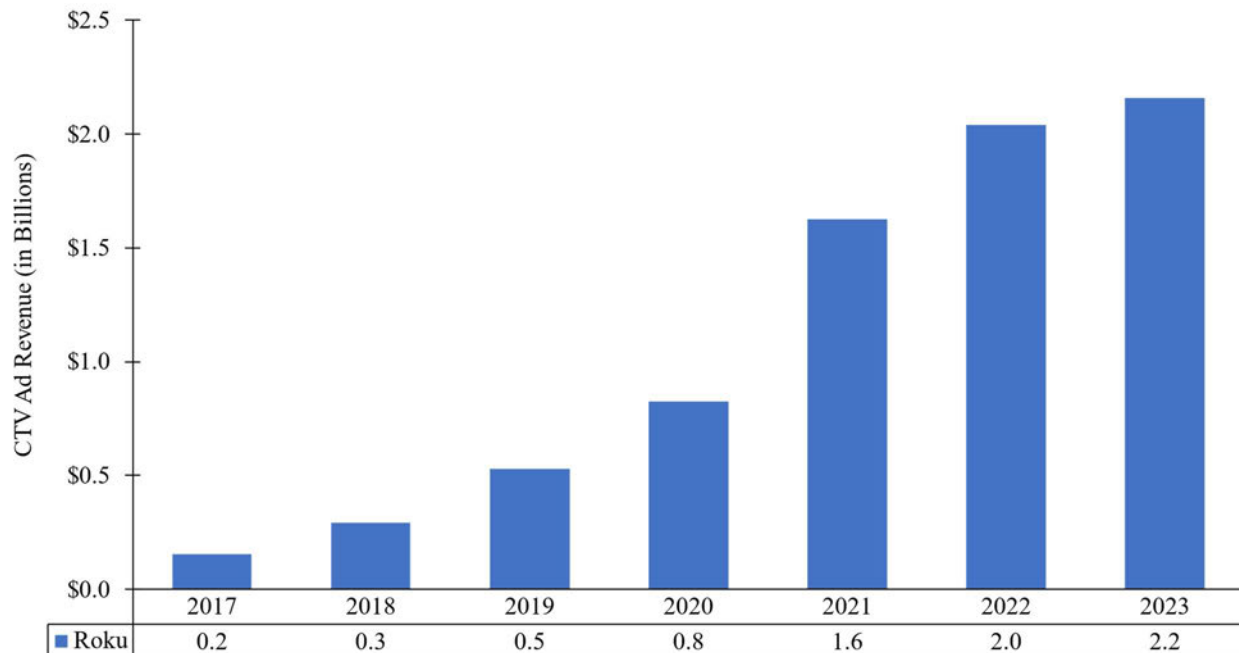
<sup>239</sup> GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics,” Rows 704, 748).

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b. Roku

89. Roku was founded in 2002 as a company specializing in hardware and software for streaming digital media.<sup>240</sup> In addition, Roku invested in ad products to help publishers (*i.e.*, content creators) monetize their content through advertising. **Figure 19** shows the growth of Roku’s ad revenue in the U.S. since 2017. Roku’s ad revenue reached \$2.2 billion in 2023, an increase of more than tenfold compared to its ad revenue in 2017.

**Figure 19. Roku’s Ad Revenue in the U.S., 2017-2023**



**Notes:**

[1] According to eMarketer, the ad revenue presented above includes advertising that appears on CTV devices.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

90. In 2015, Roku introduced Roku Audience Solutions, comprising advertising and measurement tools for publishers and advertisers on the Roku platform.<sup>241</sup> On the publisher side,

<sup>240</sup> “Anthony Wood,” *Forbes*, available at <https://www.forbes.com/profile/anthony-wood/?sh=53a2383a6e1c>.

<sup>241</sup> “Roku Unveils Advanced Video Advertising and Measurement Solutions,” *Roku Newsroom*, April 30, 2015, available at <https://newsroom.roku.com/news/2015/04/roku-unveils-advanced-video-advertising-and-measurement-solutions/osjc4lge-1564179703>.

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this development helped channel publishers (*i.e.*, content creators with their own branded channels on the Roku platform)<sup>242</sup> sell their ad space more efficiently by integrating advertising functionalities directly into the publishers' channels.<sup>243</sup> On the advertiser side, this development allowed advertisers to reach and engage their target audiences on Roku. These audience targeting capabilities have helped Roku compete with Google in attracting advertiser budgets from Google's ad buying tools, given that Roku can "leverage logged in user data for audience matching & measurement."<sup>244</sup>

91. In June 2018, Roku introduced Audience Marketplace, which provided publishers with access to Roku's first-party data based on users' interactions with Roku.<sup>245</sup>

92. In 2019, Roku's acquisition of DataXu, allowed Roku to sell ad inventory outside of its own devices and platforms.<sup>246</sup> In 2020, Roku rolled DataXu into a new single ad platform, allowing advertisers to manage their CTV, desktop, and mobile ad campaigns in one place.<sup>247</sup> Through that platform, advertisers can target their ads more effectively by accessing granular streaming audience data (*e.g.*, over 100 unique audience segments) to deliver their ads to their desired audiences.

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<sup>242</sup> "Channel publishing," *Roku Developers*, available at <https://developer.roku.com/docs/developer-program/publishing/channel-publishing-guide.md>; "How channels work," *Roku Developers*, available at <https://developer.roku.com/docs/features/how-channels-work.md>; "Channel development via the Roku SDK," *Roku Developers*, available at <https://developer.roku.com/en-ot/docs/features/channel-development-models.md>.

<sup>243</sup> "Roku Unveils Advanced Video Advertising and Measurement Solutions," *Roku Newsroom*, April 30, 2015, available at <https://newsroom.roku.com/news/2015/04/roku-unveils-advanced-video-advertising-and-measurement-solutions/osjc4lge-1564179703>; Iparampath, "Getting Started with the Roku Ad Framework," *Roku Developers*, February 10, 2016, available at <https://blog.roku.com/developer/roku-ad-framework>.

<sup>244</sup> GOOG-AT-MDL-007210197 at 197-198 (identifies that "Amazon & Roku leverage logged in user data for audience matching & measurement," and that Roku is a competitor ahead of DV360 in CTV).

<sup>245</sup> "Roku Introduces Audience Marketplace for OTT Ad Sellers and Buyers," *Roku Newsroom*, June 27, 2018, available at <https://newsroom.roku.com/news/2018/06/roku-introduces-audience-marketplace-ott-ad-sellers-and-buyers/ilmgvwa-1564179703>.

<sup>246</sup> Ben Munson, "Deeper Dive-Why Roku buying Dataxu is a big deal," *Fierce Video*, October 24, 2019, available at <https://www.fiercevideo.com/video/deeper-dive-why-roku-buying-dataxu-a-big-deal>.

<sup>247</sup> "Roku Unveils OneView Ad Platform," *Roku Newsroom*, May 5, 2020, available at <https://newsroom.roku.com/en-ca/news/2020/05/roku-unveils-oneview-ad-platform/f85qtyj9-1588642429>.

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93. In 2022, Roku allowed advertisers and agencies to use their own first-party data to plan and measure ad campaigns without relying on cookies or consortiums.<sup>248</sup> Through this collaboration, advertisers could match their own data with Roku's data, without exposing identifiable information, and then conduct their own analyses on the combined data.

c. Netflix

94. Originally founded in 1997, Netflix maintained an ad-free subscription model until recently.<sup>249</sup> In 2022, Netflix announced it would partner with Microsoft to launch a lower-priced, ad-supported subscription plan in addition to its existing ad-free plans.<sup>250</sup> Microsoft beat out Google and other ad tech providers to secure the partnership.<sup>251</sup> The ad-supported plan, which launched in late 2022, allows users to access content on the Netflix platform at a lower price.<sup>252</sup> It also provides advertisers with targeting capabilities, verification tools, and measurement solutions to help them reach their desired audiences and maximize the effectiveness of their ad campaigns.<sup>253</sup>

95. In May 2024, Netflix announced that it will build its own ad tech product by the end of 2025.<sup>254</sup> The change will allow Netflix to provide different advertising experiences for its users, and advertising options for advertisers. Netflix also said that in 2024, it will "expand its buying

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<sup>248</sup> "Roku's Clean Room Debuts for Advertisers Ahead of TV Upfronts," *Roku Newsroom*, April 19, 2022, available at <https://newsroom.roku.com/news/2022/04/roku-s-clean-room-debuts-for-advertisers-ahead-of-tv/tefx2kfp-1650310700>.

<sup>249</sup> Netflix launched streaming video in 2007, which allowed subscribers to watch series and films online. Before then, DVDs were rented to subscribers via postal mail. *See* "The Story of Netflix," *Netflix*, available at <https://about.netflix.com/en>.

<sup>250</sup> Greg Peters, "Netflix to Partner With Microsoft on New Ad Supported Subscription Plan," *Netflix*, July 13, 2022, available at <https://about.netflix.com/en/news/netflix-partners-with-microsoft>.

<sup>251</sup> Jordan Parker Erb, "How Microsoft beat Google to win Netflix's advertising business," *Business Insider*, July 15, 2022, available at <https://www.businessinsider.com/how-microsoft-beat-google-comcast-won-netflix-advertising-tier-2022-7>.

<sup>252</sup> Greg Peters, "Netflix Starting From \$6.99 a Month," *Netflix*, October 13, 2022, available at <https://about.netflix.com/en/news/announcing-basic-with-ads-us>.

<sup>253</sup> Greg Peters, "Netflix Starting From \$6.99 a Month," *Netflix*, October 13, 2022, available at <https://about.netflix.com/en/news/announcing-basic-with-ads-us>.

<sup>254</sup> Nikki Merkouris, "Netflix Upfront 2024: The Year of Growth and Momentum," *Netflix*, May 15, 2024, available at <https://about.netflix.com/en/news/netflix-upfront-2024-the-year-of-growth-and-momentum>; Lauren Forristal, "Netflix to take on Google and Amazon by building its own ad server," *Techcrunch*, May 15, 2024, available at <https://techcrunch.com/2024/05/15/netflix-in-house-advertising-technology-platform/>.

capabilities to include The Trade Desk, Google’s Display & Video 360, and Magnite who will join Microsoft as the main programmatic partners for advertisers.”<sup>255</sup> Thus, not only is Netflix a competitor to Google for media budgets,<sup>256</sup> but these changes also illustrate the competition that Google faces from publishers developing their own in-house publisher ad servers and from rival ad buying tools vying for media budgets.

**C. Advertisers and publishers can substitute between direct and indirect ad placements.**

96. Plaintiffs’ experts argue that “programmatic direct transactions are not a reasonable substitute for indirect, open web transactions” for publishers<sup>257</sup> or for smaller advertisers.<sup>258</sup> But this distinction ignores the reality that direct deals can be substitutes for indirect deals.

97. Indeed, contrary to Dr. Chandler’s assertion about a clear distinction between direct and indirect ad sales,<sup>259</sup> Professor Gans himself recognizes that some publishers like Bloomberg have shifted their indirect advertising sales to direct deals.<sup>260</sup>

98. On the advertiser side, Professor Gans does not provide any support for his proposition that direct deals “are out of reach for most smaller advertisers.”<sup>261</sup> Indeed, [REDACTED]

[REDACTED]

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<sup>255</sup> Nikki Merkouris, “Netflix Upfront 2024: The Year of Growth and Momentum,” *Netflix*, May 15, 2024, available at <https://about.netflix.com/en/news/netflix-upfront-2024-the-year-of-growth-and-momentum>.

<sup>256</sup> GOOG-AT-MDL-012978414 at 418 (identifying Netflix as one of Google’s “digital competitors” for LVMH’s advertising budget).

<sup>257</sup> Gans Report, ¶ 200.

<sup>258</sup> Gans Report, ¶ 238 (“The second option is for advertisers to transact directly with publishers. [...] [This] option[ is] investment-intensive, and [is] out of reach for most smaller advertisers.”)

<sup>259</sup> Chandler Report, ¶¶ 107-111.

<sup>260</sup> Gans Report, ¶ 50 (“Bloomberg no longer allows third parties to display ads to their audiences through automated ad auctions and requires advertisers to work with them directly.”); M. Scott Havens, “Shifting to an Audience-First Mentality,” *Bloomberg Media*, October 24, 2022, available at <https://www.bloombergmedia.com/press/shifting-to-an-audience-first-mentality/> (“Starting January 1, 2023, Bloomberg Media will no longer allow third parties to sell ads to our audience through open-market third-party programmatic, or other non-direct sold ‘demand channels,’ across our website and apps. Going forward, if brands want to reach our audience, they’ll need to work directly with our world class media team.”).

<sup>261</sup> Gans Report, ¶ 238.



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[REDACTED].<sup>262</sup> And Professor Gans ignores evidence that advertisers can substitute between direct and indirect ad buying. For example, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]<sup>264</sup>; and [REDACTED]

[REDACTED].<sup>265</sup>

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262 [REDACTED]

263 [REDACTED]

264 [REDACTED]

265 [REDACTED]

**IV. ADVERTISERS MEASURE THE EFFECTIVENESS OF THEIR DIGITAL AD SPENDING AND REALLOCATE THEIR BUDGETS TO MAXIMIZE RETURN ON INVESTMENT.**

99. Plaintiffs’ experts recognize that digital advertising has displaced traditional advertising over time, and they attribute that trend in part to advertisers’ ability to measure the success of different advertising campaigns and to reallocate digital advertising spending to achieve better advertising results.<sup>266</sup> As Dr. Chandler states, “[o]ne of the most basic concepts marketing analysts measure is called efficiency [...] measured as the return on an investment (ROI) or return on ad spend (ROAS).”<sup>267</sup> And Plaintiffs’ experts acknowledge that advertisers “maximize their [ROI]” by “directly track[ing] the performance of their advertising campaigns, such as how many people and what types of people view the ad, click on it, make a purchase, etc.”<sup>268</sup>

100. However, Plaintiffs’ experts ignore that advancements in measurement have promoted fluidity of advertiser spending and substitution across different formats, devices, and properties in pursuit of the highest return on ad spending.<sup>269</sup> For example, Dr. Chandler contends that large advertisers “start by setting an overall annual marketing budget. [...] The total dollar amount is allocated across various marketing channels and activities. Once these allocations are made, spends rarely shift across channels dramatically. [...] Reallocating budget across channels is more similar to turning an oil tanker than driving a race car.”<sup>270</sup> This is at odds with my experience and evidence in this case.

101. As an initial matter, Dr. Chandler does not define what he means by “rarely” and “dramatically,”<sup>271</sup> let alone provide any analysis of the documents and data in this case to show how often reallocation decisions are made. As I have noted in my research, “[t]he increasing

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<sup>266</sup> Chandler Report, ¶¶ 24-26, 254; Gans Report, ¶ 58.

<sup>267</sup> Chandler Report, ¶ 257.

<sup>268</sup> Gans Report, ¶ 58; Chandler Report, ¶ 260 (“[M]arketers compare the success of campaigns across different media and try to improve the placement of their ads to optimize conversion rates.”).

<sup>269</sup> Chandler Report, ¶¶ 268-270 (“MMMs give marketers the ability to shift spend between channels, optimize their media mix, and forecast future performance.”); Gans Report, ¶ 74 (“Advertisers seek inventory that best aligns their campaign goals with their campaign budget. Advertisers choose a specific ad type or types to match the goal of a particular ad campaign.”).

<sup>270</sup> Chandler Report, ¶ 270.

<sup>271</sup> Chandler Report, ¶ 270.

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availability of individual-level data has raised the standards for measurability and accountability in digital advertising.”<sup>272</sup> Advertisers use the detailed, real-time measurement metrics available through digital advertising to measure the effectiveness of their advertising,<sup>273</sup> enabling them to reallocate their advertising budgets more efficiently and in real time across different types of advertising formats, devices, and properties. This advertiser behavior undermines Plaintiffs’ experts’ opinion that “[o]pen web display ads are a distinct type of online advertising,”<sup>274</sup> and “[o]pen web display advertising has unique characteristics and serves different purposes or goals for advertisers than other marketing channels.”<sup>275</sup> In my opinion, based on my expertise and on documents and testimony produced in this matter, advertisers measure the effectiveness of their digital ad spending and adjust their budgets across different display ad formats, devices, and properties (including traditional websites, social media platforms, retail media, mobile apps, and connected TV) as required to best meet their objectives. Depending on the advertiser and industry, these changes in budget allocation and reallocation can happen on a frequent basis.<sup>276</sup>

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<sup>272</sup> Anindya Ghose, and Vilma Todri-Adamopoulos, “Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior,” *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910 at p. 889.

<sup>273</sup> Jay Kulkarni, “5 Benefits of Establishing a Real Time Data and Insights Strategy,” *ANA*, January 24, 2022, available at <https://www.ana.net/blogs/show/id/ii-2022-data-insights-strategy>.

<sup>274</sup> Gans Report, ¶ 79.

<sup>275</sup> Chandler Report, ¶ 42. *See generally* Gans Report, Section III.B.2; Chandler Report, Sections V.A, V.B, and V.C.

<sup>276</sup> Thomas Frenkiel, “Digital marketing budget allocation in six steps,” *Funnel*, January 12, 2024, available at <https://funnel.io/blog/allocate-digital-marketing-budget> (“So, when you allocate the marketing budget for digital, you need to account for all of these objectives effectively. A good way is to split the expenses between specific one-off, time-sensitive activities, and ongoing pursuits, like email marketing or search engine marketing. This can help you determine how much budget you have for ongoing activities on average every month.”); Nathan Walker, “Mastering the Art of Allocating Your Digital Marketing Budget for Optimal ROI,” *Wizaly*, August 29, 2023, available at <https://www.wizaly.com/blog/marketing-budget-and-roi/marketing-budget-allocation-best-practices/> (“To create a marketing budget plan, start with a budget template that aligns with your goals. Break down your annual budget into monthly or quarterly allocations, and list all the marketing channels you plan to use. Prioritize channels based on past performance, target audience, and potential ROI.”); Lawrence Dy, “Stay on track: Tips for monitoring your client’s ad budget,” *Vendasta*, September 5, 2023, available at <https://www.vendasta.com/blog/monitor-ad-budget/> (“The timeliness of budget monitoring is key, too. If you’re over- or underspending, you want to know right away so you can adjust as quickly as possible. If you check in once per month, that’s 30 or so possible days that you could be flushing money down the drain or missing out on important advertising opportunities. [...] Just because you decided to funnel more money to Google ads over social media ads doesn’t mean the allocation has to stay that way. You can rework percentages at any time, taking money earmarked for an underperforming campaign or ad set and putting it into one with promising ROI instead.”).

Dr. Chandler’s oil tanker analogy, which is unsupported by any industry evidence,<sup>277</sup> understates the frequency of advertisers’ budget monitoring and reallocations across types of display advertising.

102. In this section, I describe how Plaintiffs’ experts ignore the academic literature as well as documents and data produced in this matter showing how advertisers’ ability to closely measure the performance of display advertising enables them to shift their budgets dynamically and fluidly between the different formats, devices, and properties described in **Section III**.

**A. Advertisers’ budget allocation and ad placement choices with publishers have become more dynamic and fluid with the increased ease of measurement.**

103. Advertisers have historically faced difficulties in evaluating the effectiveness of their ad spending. Those difficulties are often encapsulated in what is referred to as Wanamaker’s Riddle: “[h]alf the money I spend on advertising is wasted; the trouble is, I don’t know which half.”<sup>278</sup> As I detail in my published work, advancements in measurement techniques, along with the data and insights they provide, can help advertisers move closer to solving Wanamaker’s Riddle. “They can measure advertising effectiveness and return on investment more precisely because the huge amount of real-time data from consumers has begun to lift that dense fog.”<sup>279</sup>

104. In traditional offline advertising, the difficulty of measuring ad effectiveness and audience behavior meant that ad budgets were relatively static, and advertisers could not fluidly allocate and reallocate money among different ad categories. There were several reasons for this:

- Limited data and analytics: Before the digital age, it was challenging to collect, process, and analyze data about ad performance across different media channels. Traditional

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<sup>277</sup> Indeed, Dr. Chandler’s only support for his analogy is an article regarding allocation of advertising budgets across regions and business units that advises businesses not to make a “drastic budget shift” from one business unit or region to another. *See* Chandler Report, ¶ 270 (quoting Jonathan Gordon, Ayash Basu, and Sebastian Klapdor, “How to reallocate marketing budgets to drive growth,” *McKinsey & Company*, April 1, 2015, available at <https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/how-to-reallocate-marketing-budgets-to-drive-growth>). The article does not address allocation or reallocation of digital advertising budget across formats, properties, or devices, but does advise businesses to “migrate toward more granular, analytical, and forward-looking approaches [...] to make their dollars work for them,” which supports my opinion that advertisers can (and do) shift spend in response to performance analytics.

<sup>278</sup> Ghose (2017) at p. 159.

<sup>279</sup> Ghose (2017) at p. 163.

marketers relied on less accurate and time-consuming methods, such as surveys and focus groups, to gauge the effectiveness of their campaigns.<sup>280, 281</sup> For instance, television and radio ratings were often based on sample data that might not fully represent the viewing or listening population, and print advertising lacked concrete measures of how many individuals actually read or engaged with an ad, rather than the number of people merely exposed to it by receiving the publication. Furthermore, traditional advertising channels did not provide real-time data on ad performance. Data were typically provided at the end of the advertising campaign.<sup>282</sup> This made it difficult for advertisers to quickly identify underperforming campaigns and reallocate budgets accordingly.

- Longer lead times: Traditional advertising channels like print, linear television, and radio typically required longer lead times for ad production and placement.<sup>283</sup> This made it difficult for advertisers to quickly respond to changes in ad performance and allocate budgets among different media types.

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<sup>280</sup> See, e.g., “Six reasons why social media advertising is better than traditional advertising,” *Bannerflow*, available at <https://www.bannerflow.com/blog/why-social-media-advertising-is-better-than-traditional-advertising/> (“Traditional advertising relies on data from market studies, including consumer surveys and focus groups. These sources of information can take significant amounts of time to prepare and collate.”).

<sup>281</sup> Some traditional marketers used quantitative marketing techniques such as factor analyses and conjoint analyses to make predictions about consumer behavior and trends as well as conduct segmentation. However, the data sets used in these analyses were often small and limited in scope, which made it difficult to draw accurate conclusions.

<sup>282</sup> Joseph T. Yun, Claire M. Segijn, Stewart Pearson, Edward C. Malthouse, Joseph A. Konstan, and Venkatesh Shankar, “Challenges and Future Directions of Computational Advertising Measurement Systems,” *Journal of Advertising*, Vol. 49, No. 4, 2020, pp. 446-458 at p. 446 (“[Measurement] is no longer something that happens at the end of the advertising process; instead, measurements of consumer behaviors become integral throughout the process of creating, executing, and evaluating advertising programs.”).

<sup>283</sup> See, e.g., “Why Ad Agencies Sometimes Take So Long,” *TotalCom Marketing Communications*, January 31, 2018, available at <https://www.totalcommarketing.com/post/why-ad-agencies-sometimes-take-so-long> (“Digital and social media ads can be launched as quickly as 24 hours. Traditional ad campaigns are a bit different. Lead times with print media can range anywhere from two days to ten weeks, depending on the content and the publication.”); “Traditional Marketing: Is It Worth Your Budget?” *Mailchimp*, available at <https://mailchimp.com/resources/traditional-marketing/> (“Your traditional marketing campaign may also take longer than a digital marketing campaign because of all the potential red tape. It takes time for advertisements to be approved and added to billboards and television, and that time can cost you money.”).

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- Inflexible contracts and commitments: Traditional advertisers, for example on linear TV, often had to commit to long-term contracts and minimum spending requirements<sup>284</sup> with media outlets, which made it challenging to adjust budgets fluidly.

105. With digital advertising, advertisers have access to large amounts of data, sophisticated analytics tools, and real-time insights, which enable them to make more informed decisions about budget allocation. Dr. Chandler recognizes this change, stating, “[i]n light of the centrality of consumer data and information in the digital advertising marketplace, and the profits that can be earned with the help of good quality data and analysis, marketing teams increasingly expend significant resources on data analysis.”<sup>285</sup> Because digital advertising does not have the same long lead times and rigid contracts as offline advertising, it allows for greater flexibility, enabling advertisers to adjust campaigns and budgets based on performance data.

106. Plaintiffs’ experts acknowledge that advertisers measure the return on their digital advertising spending against key performance indicators to achieve the highest returns for their advertising budgets,<sup>286</sup> but they fail to recognize how measurement lays the groundwork for advertisers to fluidly substitute their ad spending across different types of display advertising.

107. Advancements in measurement techniques have enhanced advertisers’ ability to evaluate the reach, efficiency, and effectiveness of different types of display ad formats, devices, and properties. Instead of being siloed into inflexible categories, advertising budgets are often now allocated and reallocated based on the measurable effectiveness of a campaign across a number of categories. As my co-authors and I have noted, “advertisers are increasingly undertaking

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<sup>284</sup> See, e.g., Vincent Flood, Tim Cross, and Dan Meier, “The CTV Advertising Guide 2023,” *Videoweeek*, available at <https://videoweeek.com/wp-content/uploads/2022/09/CTV-Advertising-Guide-2023.pdf> (“Large minimum spend requirements have traditionally made linear TV unaffordable for SMEs.”).

<sup>285</sup> Chandler Report, ¶ 254; see also Gans Report, ¶ 58 (“Advertisers can target their ads towards customers that are more likely to purchase the product, for example, based on demographics such as age, gender, location, etc. or the users’ online behavior such as browsing history.”).

<sup>286</sup> Gans Report, ¶ 58 (“In addition, advertisers can directly track the performance of their advertising campaigns, such as how many people and what types of people view the ad, click on it, make a purchase, etc., which allows them to refine their targeting and maximize their return on investment.”); Chandler Report, ¶ 260 (“[M]arketers compare the success of campaigns across different media and try to improve the placement of their ads to optimize conversion rates.”).

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carefully curated randomized field experiments and leveraging advanced machine learning and econometric methods to evaluate the effectiveness of marketing interventions.”<sup>287</sup>

108. This paradigm shift is rooted in data-driven decision-making, where advertiser choices—such as between social and other types of display ads and between web and in-app—are increasingly driven by measurement of returns and consumer engagement. If a particular ad format, device, or property proves to yield better results, it is likely to attract more spending. For example, Google Analytics includes a tool that allows advertisers to measure ROI and ROAS performance across different ad types.<sup>288</sup> In this important sense, different types of display ads are in direct competition with one another. Ad tech has allowed advertisers to measure performance of their campaigns and reallocate budgets to be more effective.

109. As Plaintiffs’ experts acknowledge, advertisers have long realized the importance of allocating spending across marketing channels based on the productivity of that spending.<sup>289</sup> Other things held constant, ad channels with relatively higher returns on advertiser spending are more likely to be candidates for an increase in resource allocation because those channels offer higher value. With the advent of digital advertising, advertisers can often see highly granular data about, for example, how long users viewed a digital ad, who clicked on an ad, whether the view or click led to a purchase, and much more.<sup>290</sup> These data provide specific and actionable insights, allowing advertisers to adapt quickly and optimize their campaigns. Traditional analytical methods, as well as machine learning and A/B testing, are increasingly used to analyze

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<sup>287</sup> Tony Haitao Cui, Anindya Ghose, Hanna Halaburda, Raghuram Iyengar, Koen Pauwels, S. Sriram, Catherine Tucker, and Sriraman Venkataraman, “Informational Challenges in Omnichannel Marketing: Remedies and Future Research,” *Journal of Marketing*, Vol. 85, No. 1, 2021, pp. 103-120 at p. 111.

<sup>288</sup> “Return on investment (ROI),” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/14090?hl=en>; “About Target ROAS bidding,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/6268637>; “The Tools tab,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/1722070?hl=en>.

<sup>289</sup> Chandler Report, ¶ 268 (“As marketing evolved, Marketing Mix Modeling (MMM) emerged as a scientific approach to evaluating the impact of marketing channels on sales and conversions. [...] MMMs give marketers the ability to shift spend between channels, optimize their media mix, and forecast future performance.”).

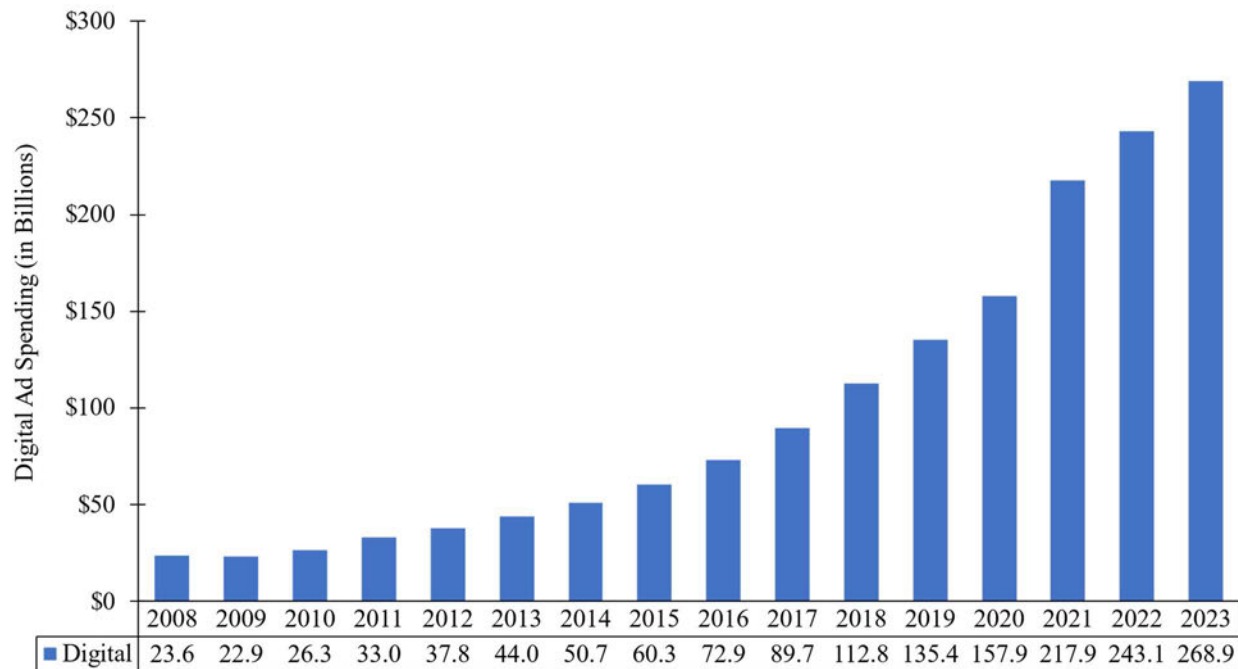
<sup>290</sup> Anindya Ghose, and Vilma Todri-Adamopoulos, “Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior,” *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910.



digital advertising data.<sup>291</sup> Digital advertising also enables more precise targeting, ensuring that ads reach specific, defined audiences.

110. Thus, it is not surprising that advertisers have been increasing their share of spending on digital advertising since 2008. As shown in **Figure 20**, advertisers’ total spending on digital ads has grown dramatically since 2008 and now amounts to over \$250 billion per year.

**Figure 20. Digital Ad Spending in the U.S., 2008-2023**



**Notes:**

[1] According to eMarketer, the ad spending presented above includes all formats of advertising that appear on desktop and laptop computers as well as mobile phones, tablets, and other internet-connected devices.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597217 (tab “US Ad Spend Metrics”).

111. Advertisers of all sizes now have access to many modern marketing analytics tools. As one Nielsen article reports, “Granular data and scalable marketing solutions are providing brands of all sizes with the insights they need to make real-time, actionable decisions. In response to burgeoning needs, marketers are ramping up their investment in marketing tech tools to ensure

<sup>291</sup> See, e.g., Kayla Carmicheal, “A/B Testing on Facebook: How to Do It Right,” *HubSpot*, February 23, 2023, available at <https://blog.hubspot.com/blog/tabid/6307/bid/30893/how-to-split-test-your-facebook-ads-to-maximize-conversions.aspx>.

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marketing budgets are well allocated. Ultimately, this will close the data knowledge gap and place companies with mid- and small budgets on a more level playing field with large companies.”<sup>292</sup>

112. In addition, advertisers also have access to measurement and verification partners and use those entities to verify that their advertisements were delivered correctly and to measure the performance and impact of their advertising campaigns. Publishers use these partners’ services to verify and measure a variety of metrics, including website traffic, total page views, bounce rates, total impressions,<sup>293</sup> cost per click (CPC), cost per mille (CPM), cost per action (CPA), click-through rate (CTR), and conversion rate (CVR).<sup>294</sup>

113. Ad verification providers help advertisers understand the quality and effectiveness of their ads and help identify ad fraud by checking viewability.<sup>295</sup> As my research shows, advertisers today can assess not only if someone has seen an ad, but also how long the consumer has seen the ad for.<sup>296</sup> In addition, advertisers have insight into whether an ad was displayed next to inappropriate content, which could impact a brand’s image.<sup>297</sup> For publishers, ad verification helps minimize the risk of fraudulent ads appearing on their sites and allows for better control of ads displayed.<sup>298</sup>

114. Plaintiffs’ experts fail to recognize the importance of data-driven approaches that advertisers apply across the different display ad formats, devices, and properties that they utilize

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<sup>292</sup> “How to Maximize Marketing ROI at Every Budget Size,” *Nielsen*, April 2021, available at <https://www.nielsen.com/insights/2021/how-to-maximize-marketing-roi-at-every-budget-size/>.

<sup>293</sup> An “Impression,” also known as an “ad view,” is “counted every time a creative (ad) is served to a user.” See “Impression,” *Clearcode*, available at <https://clearcode.cc/glossary/impression/>.

<sup>294</sup> See, e.g., Michal Wlosik, “What is Ad Verification and How Does It Work?” *Clearcode*, April 26, 2024, available at <https://clearcode.cc/blog/ad-verification/>; Matthew Whille, “The 10 Advertising Metrics Every Publisher Should Track,” *Newor Media*, January 21, 2023, available at <https://newormedia.com/blog/advertising-metrics-to-track/>.

<sup>295</sup> “Guidelines for the Conduct of Ad Verification,” *IAB*, February 14, 2012, available at <https://www.iab.com/wp-content/uploads/2015/06/Ad-Verification-Guideline-for-the-Conduct-of.pdf>.

<sup>296</sup> Anindya Ghose, and Vilma Todri-Adamopoulos, “Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior,” *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910 at p. 889.

<sup>297</sup> See, e.g., Michal Wlosik, “What is Ad Verification and How Does It Work?” *Clearcode*, April 26, 2024, available at <https://clearcode.cc/blog/ad-verification/>.

<sup>298</sup> See, e.g., Michal Wlosik, “What is Ad Verification and How Does It Work?” *Clearcode*, April 26, 2024, available at <https://clearcode.cc/blog/ad-verification/>.

in their campaigns to measure and allocate their spending. This results in Plaintiffs’ experts underappreciating the extent to which advertising dollars shift between the Plaintiffs’ so-called “open web display advertising” and other types of display advertising. In my experience working with advertisers and ad agencies, statistical tools, such as Marketing Mix Modeling and Multi-Touch Attribution, can be used to compare and contrast, for example, social media properties, retailer properties, CTV platforms, mobile apps, and other websites or apps. Advertisers’ use of these methods to compare performance across formats, devices, and properties, which fall both inside and outside of Plaintiffs’ experts’ concept of “open web display advertising,” demonstrates their joint consideration of multiple ad formats, ad properties, and ad devices in the same allocation decisions.<sup>299</sup>

- **Marketing Mix Modeling (MMM)** is a statistical analysis tool used by marketers to measure the effectiveness of each of their marketing activities. The model analyzes historical data on marketing activities (including advertising) and measures those activities’ impact on sales or other performance metrics. MMM helps advertisers understand how various marketing activities are driving sales to determine the optimal allocation of spending across different types of advertising by measuring the ROI for a “mix” of spending on different formats and properties, including websites, social media platforms, retail media, mobile apps, video streaming services, and others.
  - MMM takes into account two types of data<sup>300</sup>: (1) base drivers (*i.e.*, external factors unrelated to marketing decisions and ad spending, such as seasonality, holidays, brand value, or economic conditions like GDP, growth rate, and consumer sentiment, which can impact marketing performance<sup>301</sup>); and (2) incremental drivers (*i.e.*, marketing and promotional activities, such as advertising, discounts, promotions, or social media outreach). In the context of

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<sup>299</sup> See, e.g., Michael Taylor, “The Beginner’s Guide To Marketing Mix Modeling (MMM),” *Measured*, August 2, 2023, available at <https://www.measured.com/blog/the-beginners-guide-to-marketing-mix-modeling-mmm/>.

<sup>300</sup> “A complete guide to Marketing Mix Modeling,” *Latent View*, available at <https://www.latentview.com/marketing-mix-modeling/>.

<sup>301</sup> “A complete guide to Marketing Mix Modeling,” *Latent View*, available at <https://www.latentview.com/marketing-mix-modeling/>.

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display advertising, such data on incremental drivers can include the amount of ad spending across different devices, ad formats, and digital properties.

- Using this data, advertisers may use a linear regression or multiplicative regression, and the results of the regression model provide insights that they can use to optimize marketing investment allocations.<sup>302</sup>
- **Multi-Touch Attribution (MTA)** is a statistical analysis used to assign credit or value to each touchpoint or interaction that a customer has with a brand—for example, clicking an ad, viewing an ad, purchasing a product, installing a mobile app, or signing up for an email list—before making a purchase or taking another desired action.<sup>303</sup> By understanding the relative value of each touchpoint, marketers can optimize their advertisements to better engage customers and drive conversions, engagement, and ROI. MTA takes into account three types of data: (1) user-level data (such as individual ad impressions, clicks, and conversions); (2) touchpoint data (regarding each touchpoint along the consumer’s path to purchase) to assign credit to each touchpoint; and (3) interaction data (for example, the time, sequence, and frequency of touchpoints) to refine the attribution process.<sup>304</sup> If certain ad formats or properties are found to be more effective, advertisers reallocate more spending to those formats or properties to optimize ROI.<sup>305</sup> Advertisers can use various attribution models to allocate value to each “touch” (or interaction between advertiser and consumer).<sup>306</sup> As [REDACTED]

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<sup>302</sup> “The Essential Guide to Marketing Mix Modeling and Multi-Touch Attribution,” *IAB*, November 2019, available at [https://www.iab.com/wp-content/uploads/2019/11/IAB\\_MMA\\_MTA-Guidebook\\_Nov-2019.pdf](https://www.iab.com/wp-content/uploads/2019/11/IAB_MMA_MTA-Guidebook_Nov-2019.pdf).

<sup>303</sup> Kristen Baker, “Multi-Touch Attribution and Models: A Complete Guide,” *HubSpot*, April 21, 2021, available at <https://blog.hubspot.com/marketing/multi-touch-attribution>.

<sup>304</sup> “Multi-Touch Attribution (MTA) Implementation and Evaluation Primer,” *IAB*, April 2017, available at [https://www.iab.com/wp-content/uploads/2017/04/IAB\\_Multi-Touch\\_Attribution\\_Primer\\_2017-04.pdf](https://www.iab.com/wp-content/uploads/2017/04/IAB_Multi-Touch_Attribution_Primer_2017-04.pdf); “Multi-Touch Attribution: What It Is & How To Use It,” *Marketing Evolution*, July 20, 2022, available at <https://www.marketingevolution.com/marketing-essentials/multi-touch-attribution>.

<sup>305</sup> As a matter of clarity, multi-channel attribution weighs attribution credit by channel (social, paid, organic) and does not factor in specific touchpoints, messaging, or sequence. In contrast, multi-touch attribution is more granular, focusing on specific ads, including which channel they ran on, the message, and the sequence of interaction. *See, e.g.*, “Multi-Touch Attribution: What It Is & How To Use It,” *Marketing Evolution*, July 20, 2022, available at <https://www.marketingevolution.com/marketing-essentials/multi-touch-attribution>.

<sup>306</sup> A first-touch attribution model assigns full conversion-to-sale credit to the consumer’s first touchpoint with the advertiser, even if the purchaser was exposed to many subsequent advertisements. By contrast, a last-touch model assigns full conversion-to-sale credit to the last touchpoint. In a uniform model, every touchpoint

receives equal credit for a conversion, and a time decay model assigns higher conversion credit to more recent touchpoints. In addition to rule-based attribution, there has also been a rise in algorithmic attribution, which uses statistical models and machine learning algorithms to predict the contribution of each touchpoint to the final conversion. Academics have discussed the limits of heuristics such as last- and first-click attribution shortcuts and found that last-click attribution can underestimate the effectiveness of some types of interventions and lead to suboptimal budget allocation. See Hongshuang (Alice) Li, and P. K. Kannan, “Attributing Conversions in a Multichannel Online Marketing Environment: An Empirical Model and a Field Experiment,” *Journal of Marketing Research*, Vol. 51, No. 1, 2014, pp. 40-56; Tony Haitao Cui, Anindya Ghose, Hanna Halaburda, Raghuram Iyengar, Koen Pauwels, S. Sriram, Catherine Tucker, and Sriraman Venkataraman, “Informational Challenges in Omnichannel Marketing: Remedies and Future Research,” *Journal of Marketing*, Vol. 85, No. 1, 2021, pp. 103-120; Chris Haleua, “Algorithmic Attribution: Choosing the Attribution Model That’s Right for Your Company,” *Adobe Blog*, January 12, 2017, available at <https://blog.adobe.com/en/publish/2017/01/12/algorithmic-attribution-choosing-attribution-model-thats-right-company>.

*see also*

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North America, 53% of the respondents are currently using MTA to track performance, and an additional 30% plan to do so in the next 6-18 months.<sup>311</sup> The International Advertising Bureau published a primer on MTA back in 2017<sup>312</sup> and several practitioners have discussed it even earlier in 2014.<sup>313</sup>

116. In addition, MMM is widely used by firms across a variety of industries including banking, supermarket, beverage, consumer packaged goods, telecom, nutrition, entertainment, travel, B2B, and others to “help[] marketers make informed decisions regarding budget allocations across channels and tactics.”<sup>314</sup> MTA is also widely used across several industries, including tech, local restaurants, global retail chains, consumer packaged goods, and even B2B to “guide decisions about future marketing spend.”<sup>315</sup> Many firms are increasingly adopting both modeling approaches.<sup>316</sup> Advances in machine learning and AI have enhanced the capabilities of both MMM and MTA, enabling marketers to analyze vast data sets more effectively and adjust

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<sup>311</sup> “State of Attribution Annual Marketer Survey,” *MMA Global*, July 2022, available at [https://www.mmaglobal.com/files/documents/state\\_of\\_attribution\\_benchmark\\_report\\_2022.pdf](https://www.mmaglobal.com/files/documents/state_of_attribution_benchmark_report_2022.pdf).

<sup>312</sup> “Multi-Touch Attribution (MTA) Implementation and Evaluation Primer,” *IAB*, April 2017, available at [https://www.iab.com/wp-content/uploads/2017/04/IAB\\_Multi-Touch\\_Attribution\\_Primer\\_2017-04.pdf](https://www.iab.com/wp-content/uploads/2017/04/IAB_Multi-Touch_Attribution_Primer_2017-04.pdf).

<sup>313</sup> Daniel Kehrner, “The Truth About Cross-Channel Attribution In Marketing,” *Forbes*, June 26, 2015, available at <https://www.forbes.com/sites/forbesinsights/2014/12/02/cross-channel-attribution/>; Kohko Yamaguchi, “3 Challenges Of Attribution Modeling: The Bad, The Bad And The Ugly,” *MarTech*, September 25, 2014, available at <https://martech.org/3-challenges-attribution-modeling-bad-bad-ugly/>.

<sup>314</sup> “Marketing Mix Modeling: Everything You Need to Know,” *Analytic Edge*, available at <https://analytic-edge.com/blog/what-is-marketing-mix-modeling/>; MMA / Ipsos, “The Current State of Marketing Mix Modeling and Marketers’ Concerns Discussed at Google SuMMMit 2024,” *Marketing Management Analytics*, March 12, 2024, available at <https://mma.com/blog/the-current-state-of-marketing-mix-modeling/>; AnalytixLabs, “Marketing Mix Modeling: How MMM Models Help in Predicting ROI of a Marketing Strategy?” *Medium*, December 10, 2023, available at <https://medium.com/@byanalytixlabs/marketing-mix-modeling-how-mmm-models-help-in-predicting-roi-of-a-marketing-strategy-f44e504fda54>.

<sup>315</sup> Jacqueline Dooley, “Marketing attribution: What it is, and how it identifies vital customer touchpoints,” *MarTech*, April 5, 2022, available at <https://martech.org/marketing-attribution-what-it-is-and-how-it-identifies-vital-customer-touchpoints/>; “How to improve marketing ROI using Multi-touch Attribution for CPG brands,” *Sigmoid*, available at <https://www.sigmoid.com/blogs/improve-marketing-roi-with-mta-for-cpg/>; “The Essential Guide to Marketing Mix Modeling and Multi-Touch Attribution,” *IAB*, November 2019, available at [https://www.iab.com/wp-content/uploads/2019/11/IAB\\_MMA\\_MTA-Guidebook\\_Nov-2019.pdf](https://www.iab.com/wp-content/uploads/2019/11/IAB_MMA_MTA-Guidebook_Nov-2019.pdf).

<sup>316</sup> A survey indicates that 41% of marketing organizations are using marketing attribution modeling, including MMM and MTA, as a measure of ROI. See Scott Rheinlander, “Everything You Wanted to Know About Marketing Attribution Models (but Were Afraid to Ask),” *The 360 Blog*, April 19, 2019, available at <https://www.salesforce.com/blog/what-is-marketing-attribution-model/>.

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models regularly with new data.<sup>317</sup> My co-authors and I have investigated various issues in attribution modeling and published causal modeling approaches in digital attribution in collaboration with companies.<sup>318</sup> An article cited by Dr. Chandler shows how online search interest in MMM has been picking up since 2021.<sup>319</sup>

117. Although Plaintiffs’ experts fail to address the importance of these methods to advertisers to measure and allocate their ad spending, in my experience, advertisers routinely use these commonly applied methods to assist with their overall budgeting and allocation decisions across ad formats, devices, and properties. As I noted in my book in 2017, “From a big picture perspective, an appropriate digital attribution framework [...] facilitates performance-based advertising by allowing advertisers to reward their digital display networks partners on the basis of their true effectiveness in driving key marketing objectives. It allows advertisers to perform real-time analysis of their advertising campaigns.”<sup>320</sup>

118. Dr. Chandler’s comments regarding the usage of MMM are outdated and have no reliable basis or support.<sup>321</sup> Dr. Chandler claims, “There is a great deal of statistical noise in the marketing measurement system, and discerning the cause of changes to performance can be difficult. This causes marketers to adopt a ‘don’t rock the boat’ attitude toward shifting the marketing.”<sup>322</sup> This opinion is a gross overstatement of market reality. While marketing measurement systems can be affected by statistical noise, like any other measurement system, sophisticated techniques including time series analysis, causal inference, predictive models, and

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<sup>317</sup> JP Pereira, “Unifying multitouch attribution and marketing mix modelling,” *Smart Insights*, November 8, 2018, available at <https://www.smartinsights.com/goal-setting-evaluation/performance-management/unifying-multitouch-attribution-marketing-mix-modelling/>.

<sup>318</sup> Tony Haitao Cui, Anindya Ghose, Hanna Halaburda, Raghuram Iyengar, Koen Pauwels, S. Sriram, Catherine Tucker, and Sriraman Venkataraman, “Informational Challenges in Omnichannel Marketing: Remedies and Future Research,” *Journal of Marketing*, Vol. 85, No. 1, 2021, pp. 103-120; Anindya Ghose, and Vilma Todri-Adamopoulos, “Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior,” *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910.

<sup>319</sup> Gufeng Zhou, Igor Skokan, and Julian Runge, “Packaging Up Media Mix Modeling: An Introduction to Robyn’s Open-Source Approach,” *Arxiv*, available at <https://arxiv.org/pdf/2403.14674> (cited in Chandler Report, ¶ 269, Footnote 137).

<sup>320</sup> Ghose (2017) at 163-164.

<sup>321</sup> Chandler Report, ¶ 269.

<sup>322</sup> Chandler Report, ¶ 269.



experimental analyses help marketers account for this noise and identify meaningful patterns.<sup>323</sup> By understanding the sources of noise and applying robust methodologies, marketers are able to mitigate the impact of noise. Moreover, many marketers are increasingly aware that a dynamic and adaptive marketing strategy, rather than a stagnant “don’t rock the boat” approach, is essential for staying competitive.<sup>324</sup> As a result, and as I describe in **Section IV.B** below, advertisers indeed take a dynamic approach, shifting their spending in response to changes in performance.

119. In summary, advertisers face an allocation decision as to how much to invest in different ad types and digital channels. These decisions can include, for example, allocation across different digital ad properties (*e.g.*, what Plaintiffs call “open web” versus social media or other properties); device types (*e.g.*, mobile versus desktop); or formats (*e.g.*, native versus video display versus non-video display). Advertisers’ decisions about budget allocations are periodically reevaluated based on campaign performance, and advertisers periodically optimize and switch advertising spending to maximize their ROI (*i.e.*, increases in sales relative to the expenditure on advertising).<sup>325</sup> This iterative process of adaptation is crucial for those marketers who aim to optimize their advertising strategies and maximize ROI.<sup>326</sup> In addition to ROI, advertisers may rely on other metrics and factors to guide their budget reallocation decisions, such as click-through rates (CTRs), ad placement profitability, changes in consumer preferences,

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<sup>323</sup> “Time Series Analysis and Forecast Service for Your Business,” *Research Optimus*, available at <https://www.researchoptimus.com/article/what-is-time-series-analysis.php>; “Using science to evaluate marketing campaign effectiveness,” *Walmart Global Tech*, October 25, 2023, available at [https://tech.walmart.com/content/walmart-global-tech/en\\_us/blog/post/using-science-to-evaluate-marketing-campaign-effectiveness.html](https://tech.walmart.com/content/walmart-global-tech/en_us/blog/post/using-science-to-evaluate-marketing-campaign-effectiveness.html); “How to Use Marketing Experimentation to Boost Your Marketing ROI,” *Userpilot Blog*, September 28, 2023, available at <https://userpilot.com/blog/marketing-experimentation/>.

<sup>324</sup> Emma Bentley, “What is Dynamic Marketing Strategy and How to Get Started,” *Marketing Insider Group*, April 10, 2024, available at <https://marketinginsidergroup.com/best-practices/dynamic-marketing-strategy/>; “The Benefits of Adaptive Marketing for Businesses,” *Mailchimp*, available at <https://mailchimp.com/resources/adaptive-marketing/>.

<sup>325</sup>

[REDACTED]

<sup>326</sup> P. Rajan Varadarajan, and Manjit S. Yadav, “Marketing Strategy and the Internet: An Organizing Framework,” *Journal of the Academy of Marketing Science*, Vol. 30, No. 4, 2002, pp. 296-312.

seasonal trends in product demand, and/or industry innovations that offer new opportunities for effective ad delivery.<sup>327</sup>

**B. Evidence produced in this case demonstrates how advertisers reallocate ad spending based on various performance evaluation metrics.**

120. Plaintiffs’ experts fail to acknowledge the vast documentary and testimonial record in this matter demonstrating that, given the advancements in measurement that have enabled advertisers to measure the impact of their advertising in unprecedented ways, advertisers shift spending across the formats and properties set out in **Section III** above based on performance.

***1. Advertisers use data-driven approaches to measuring advertising effectiveness.***

121. Various testimony and documents produced in this matter illustrate how some organizations put emphasis on adopting a data-driven approach to measure advertising effectiveness. For example:

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[REDACTED]  
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<sup>327</sup> “Determining Your Business’s Marketing Budget,” *Digital School of Marketing*, available at <https://digitalschoolofmarketing.co.za/digital-marketing-blog/determining-an-appropriate-marketing-budget-key-factors-and-considerations/>; Ana Gotter, “How to Determine a Marketing Budget for Your Brand,” *Single Grain*, available at <https://www.singlegrain.com/marketing-strategy/how-to-determine-a-marketing-budget-for-your-brand/>; Uwe Dreissigacker, “6 Factors that Impact Your Marketing Budget in Uncertain Times,” *Customer Think*, May 6, 2020, available at <https://customerthink.com/6-factors-that-impact-your-marketing-budget-in-uncertain-times/>.

<sup>328</sup> [REDACTED]  
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- [REDACTED]  
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[REDACTED]<sup>330</sup>

Zulily had created a self-service data-driven platform that enabled them to have a “single view of data across various marketing touchpoints including Facebook Ads, Google Ads, and email, allowing [Zulily] to blend data with in-house sources such as clickstream, product catalog, and order transactions to make faster and better business decisions.”<sup>331</sup>

- [REDACTED]  
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- [REDACTED]  
[REDACTED]<sup>333</sup> [REDACTED]  
[REDACTED]  
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<sup>329</sup> [REDACTED]

<sup>330</sup> [REDACTED]  
[REDACTED]

<sup>331</sup> Sasha Bartashnik, “Why zulily created a self-service marketing analytics platform with Tableau and Google BigQuery,” *Tableau*, April 11, 2018, available at <https://www.tableau.com/blog/why-zulily-created-self-service-marketing-analytics-platform-tableau-and-google>.

<sup>332</sup> [REDACTED]  
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<sup>333</sup> [REDACTED]  
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***2. Advertisers reallocate spending between a range of properties that Plaintiffs’ experts artificially exclude from their analysis.***

122. As a result of the ability to measure performance, advertisers of all sizes frequently shift spending between display advertising on what Plaintiffs call the “open web” and other properties that Plaintiffs’ experts artificially exclude, such as the large social media, retail, and CTV platforms and apps.

123. There is a wealth of evidence specifically showing a shift in ad spending from the third-party publisher properties that Plaintiffs’ experts describe as the “open web” to Meta (and other properties that Plaintiffs ignore) based on performance evaluation. That evidence clearly undermines Plaintiffs’ experts’ position that social media platforms and apps with “in-house tools” such as “Walled Garden Publishers” are distinct from “open web” advertising.<sup>338</sup>

- [REDACTED]  
[REDACTED]  
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- [REDACTED]  
[REDACTED]

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<sup>338</sup> Gans Report, ¶ 168; Chandler Report, ¶ 42.

<sup>339</sup> [REDACTED]  
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- In 2019, Google received significant feedback from sellers that “advertisers [were] shifting budgets from GDN [(i.e., the Google Display Network)] to Facebook [because] of [Facebook’s LeadGen display ad] format.”<sup>345</sup>
- A 2020 internal Google email chain indicated that [REDACTED] “[p]erformance [d]isplay budgets continu[ing] to shift to Facebook where they [could] achieve scale + performance” was a challenge that Google needed to address.<sup>346</sup>
- [REDACTED]  
[REDACTED]<sup>347</sup>
- [REDACTED]  
[REDACTED]  
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- [REDACTED]  
[REDACTED]  
[REDACTED]<sup>349</sup> [REDACTED]  
[REDACTED]<sup>350</sup>

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<sup>345</sup> GOOG-DOJ-12700273 at 273.

<sup>346</sup> GOOG-AT-MDL-003537710 at 710-712.

<sup>347</sup> [REDACTED]  
[REDACTED]

<sup>348</sup> [REDACTED]  
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<sup>349</sup> [REDACTED]  
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<sup>350</sup> [REDACTED]  
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124. There is also significant evidence that advertisers shift spending not only to social media, but across a broader range of different properties:

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[REDACTED]  
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  - Google acknowledged in a 2017 strategy document that it faces “[p]ressure on demand from Facebook and other walled garden players” and that Facebook and Amazon “have

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diverted significant [advertiser] spend from 3rd party publishers to their O&O inventory.”<sup>359</sup>

- In a sell-side competition review, Google noted that “Facebook (FB) and Amazon (AMZN) have been winning more mind and market share from our top partners,” that they have “[r]obust and unique demand to rival AdWords [now Google Ads],” and that “[a]dvertisers [are] shifting significant budgets to FB and AMZN.”<sup>360</sup>
- A Google internal document from 2020 states that “Google continues to lose share of digital wallet” to its “biggest competitors (eg, FB and Amazon).”<sup>361</sup>

***3. Advertisers reallocate spending between a range of devices and formats.***

125. Documents and data produced in this matter provide further evidence that advertisers reallocate spending between different devices and ad formats.

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[REDACTED].<sup>362</sup>
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[REDACTED]  
[REDACTED].<sup>363</sup>

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<sup>359</sup> GOOG-DOJ-05526944 at 945.

<sup>360</sup> GOOG-DOJ-13952875 at 878.

<sup>361</sup> GOOG-AT-MDL-009766884 at 920.

<sup>362</sup> [REDACTED]  
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<sup>363</sup> [REDACTED]  
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[REDACTED].<sup>365</sup>

126. In order to examine heterogeneity in budget allocation based on *ad format*, I have analyzed ad engagement for three major advertisers (Nike, Macy’s, and American Express) that appeared in Google’s Campaign Manager data produced in this litigation.<sup>366</sup> Campaign Manager is an ad management system offered by Google, which allows advertisers to “manage [...] digital campaigns across website and mobile”<sup>367</sup> and provides “[a]n overview of campaign performance” and “insight into user interaction paths and [...] the role that specific channels played in [...] conversions.”<sup>368</sup> In this way, Campaign Manager can aid in making ad budget allocation decisions for advertisers.

127. The data contain information across a number of relevant ad dimensions, such as ad format, in addition to metrics, such as impressions, for select advertisers executing campaigns on

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<sup>364</sup> [REDACTED]  
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<sup>365</sup> [REDACTED]  
[REDACTED]  
[REDACTED]

<sup>366</sup> GOOG-AT-DOJ-DATA-000247044.

<sup>367</sup> “Overview of Campaign Manager 360,” *Campaign Manager 360 Help*, available at <https://support.google.com/campaignmanager/answer/2709362?hl=en><https://support.google.com/campaignmanager/answer/2709362?hl=en>.

<sup>368</sup> “Overview of Campaign Manager 360,” *Campaign Manager 360 Help*, available at <https://support.google.com/campaignmanager/answer/2709362?hl=en><https://support.google.com/campaignmanager/answer/2709362?hl=en>.

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the platform from August 2021 to June 2023. However, the data do not include information on ad spending. Instead, I tracked impressions, as these are key performance indicators for advertisers determining budget allocation. Additionally, the Campaign Manager data may not cover all of an advertiser's impressions if, for example, the advertiser only configures some of its campaigns in the tool. Regardless, the examples that follow illustrate that an advertiser's portfolio can be quite fluid, frequently being evaluated and updated.

128. I analyzed the share of impressions across all advertiser campaigns quarterly by ad format (*e.g.*, static display, video display—which includes instream and outstream video, and audio). These illustrative examples show that advertisers allocate their spending among different ad formats over time.<sup>369</sup>

129. The results of my analyses are presented in **Appendix C**. Notably, the shares of video display and static display oscillate over time for all three advertisers.

- **Figure C-1** shows the share of total impressions across all campaigns run by Nike North America Brand (“Nike”) from 2021 Q3 through 2023 Q2. The majority of Nike impressions through the earlier quarters come from video display, before switching to static display, and then back to video display.
- This pattern is reversed for Macy's Media Network (“Macy's”), shown in **Figure C-2**, for which static display ads represent the majority of impressions in the earlier period, before switching to video display ads.
- **Figure C-3** contains the equivalent analysis for American Express – Global Advertising (“American Express”). American Express's impressions from video and static display advertising increased significantly in 2021 Q3, becoming approximately equal by Q4 and remaining so into 2022 Q1. From that point forward they diverge, with video display increasingly representing the majority of impressions, but with some shifts slightly back to static display in certain quarters (2022 Q3, 2023 Q2).

130. These data exemplify the ways that advertisers today can allocate their ad spending among different types of display ads.

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<sup>369</sup> Other advertisers may shift their spending less frequently, but the Nike, Macy's, and American Express examples illustrate the general point that substitution across formats is not only possible, but actually occurs, driven by either performance metrics or other factors.

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**V. ADVERTISERS AND PUBLISHERS EXPECT AD TECH PROVIDERS TO CONDUCT EXPERIMENTS AND OPTIMIZE THE BIDDING PROCESSES.**

133. Plaintiffs’ expert Dr. Chandler contends that Google “fail[ed] to adequately or timely disclose changes to the auction’s mechanics and purposes,”<sup>370</sup> and “[e]ngaged in [e]xperiments that [e]xploited its [u]sers.”<sup>371</sup> He opines that as a result, Google’s “programs and practices jeopardized, and detrimentally affected, transparency and fairness of the auctions in which they were employed.”<sup>372</sup>

134. But Dr. Chandler fails to acknowledge that it is well understood in the industry that ad tech providers conduct experiments and optimizations, and indeed, publishers and advertisers expect their ad tech providers to do so. Experimentation and optimization are industry standard techniques to improve outcomes for advertisers and publishers, and an ad tech provider failing to do so would put its customers—and therefore its own products—at a disadvantage. Moreover, regardless of disclosures, advertisers and publishers typically do not engage with the technical

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<sup>370</sup> Chandler Report, ¶ 341.

<sup>371</sup> Chandler Report, Section X.G; *see also* Expert Report of Jeffrey S. Andrien, *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, June 7, 2024 (“Andrien Report”), ¶ 100 (“[T]here is ample evidence in the record that partial launches or experimental versions of Google’s programs that manipulated the auctions occurred well before the full launch dates. [...] [T]hese experiments were common and likely directly affected many auctions.”).

<sup>372</sup> Chandler Report, ¶ 341.

aspects of ad tech auctions. Advertisers instead rely on their ad agencies, which are sophisticated and well-versed in maximizing surplus, to develop and execute bidding strategies on their behalf, whereas publishers adapt their strategies based on their returns and rely on the optimization tools offered by third parties to increase yield.

**A. Experiments to optimize performance are prevalent and well-known in the ad tech industry.**

135. Dr. Chandler claims that Google’s experimental algorithms “[e]xploited its [users]” because they altered the functioning of Google’s auctions and were not specifically disclosed to Google’s customers.<sup>373</sup> However, Google has disclosed that it may run experiments to optimize the ad auction.<sup>374</sup> Moreover, in my experience, experiments to optimize performance are prevalent throughout the ad tech industry.<sup>375</sup>

136. Record evidence in this case further confirms that Google is hardly unique in running experiments to optimize performance:

- [REDACTED]  
[REDACTED].<sup>376</sup> [REDACTED]  
[REDACTED]

<sup>373</sup> Chandler Report, Section X.G, ¶¶ 381-382, 384.

<sup>374</sup> “Auction Model,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/152039> (“Ad Manager may run limited experiments designed to optimize the auction.”); GOOG-AT-MDL-C-000035250 (an earlier version of the “Auction Model” article with similar language: “The Google DoubleClick Ad Exchange may run limited experiments designed to optimize the auction.”). Moreover, an article published by Google notes that “[a]t Google, experimentation is practically a mantra[]” and that data to drive decisions about whether changes should be launched to users “is most commonly gathered by running live traffic experiments.” See Diane Tang, Ashish Agarwal, Deirdre O’Brien, and Mike Meyer, “Overlapping Experiment Infrastructure: More, Better, Faster Experimentation,” *Proceedings of the 16th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, 2010, pp. 17-26 at p. 17.

<sup>375</sup> As an example, a study by a team of researchers at Yahoo and Stanford University detailed experimental results from running a two-step algorithm on online traffic to determine optimal bidding strategy in digital advertising auctions. See Nian Si, San Gultekin, Jose Blanchet, and Aaron Flores, “Optimal Bidding and Experimentation for Multi-layer Auctions in Online Advertising,” *SSRN*, March 29, 2023, available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4358914](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4358914). Yahoo has further detailed its use of large field experiments on setting reserve prices in auctions for online advertisements in the sponsored search setting. See Michael Ostrovsky, and Michael Schwarz, “Reserve Prices in Internet Advertising Auctions: A Field Experiment,” *Journal of Political Economy*, Vol. 131, No. 12, pp. 3352-3376.

<sup>376</sup> [REDACTED]



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382 “Kargo Puts the Art in Ad Tech,” *Kargo*, available at <https://www.kargo.com/about>.

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[REDACTED]  
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137. Advertisers and publishers using ad tech know that such experiments occur and at times conduct their own experiments:

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[REDACTED]  
[REDACTED] 388 [REDACTED]

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384 [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
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385 [REDACTED]  
[REDACTED]  
[REDACTED]

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387 [REDACTED]

388 [REDACTED]  
[REDACTED]

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[REDACTED] 389

- [REDACTED]  
[REDACTED] 390

- [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
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- [REDACTED]  
[REDACTED] 392

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389 [REDACTED]  
[REDACTED]  
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[REDACTED]  
[REDACTED]  
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390 [REDACTED]  
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[REDACTED]  
[REDACTED]

391 [REDACTED]  
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[REDACTED]  
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[REDACTED]

392 [REDACTED]  
[REDACTED]

**B. Ad tech providers help optimize advertisers' bids and publishers' yields.**

138. In the rapidly evolving digital advertising market, ad tech tools that do not incorporate advanced optimization algorithms are at a significant disadvantage. This is because they are unable to provide the cost-efficiency and effectiveness that comes from automated, data-driven decision-making.

139. On the advertiser side, without factoring in user engagement signals and conversion likelihoods, the platform cannot precisely match ads to the most relevant and valuable audiences.<sup>393</sup> This leads to wasted ad spending on impressions with low chances of converting, which reduces the advertiser's return on investment.<sup>394</sup> For example, as some ad exchanges have shifted to first-price auctions, academic studies have looked at optimal bid shading strategies to avoid advertisers' overpaying.<sup>395</sup> Those studies have shown that bid shading experiments can improve outcomes in first-price auctions,<sup>396</sup> and that experimenting with different shading techniques helps advertisers adapt to this auction format.<sup>397</sup>

140. On the publisher side, an ad tech platform that fails to maximize the yield for the publisher can result in a lower price and less overall ad revenue for the publisher compared to

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<sup>393</sup> Ehud Basis, "Scaling Paid Campaigns via User Engagement Signals," *Outbrain Blog*, available at <https://www.outbrain.com/blog/scaling-paid-campaigns/>; Ehud Basis, "How User Engagement Signals Can Help You Scale (Part 2)," *Outbrain Blog*, available at <https://www.outbrain.com/blog/user-engagement-signals/>.

<sup>394</sup> Maulik Patel, "12 Common Google Ads Mistakes Affecting Your ROI in 2024," *Clickmatix*, June 20, 2024, available at <https://www.clickmatix.com.au/12-common-google-ads-mistakes-affecting-your-roi/>.

<sup>395</sup> Weitong Ou, Bo Chen, Xinyi Dai, Weinan Zhang, Weiwen Liu, Ruiming Tang, and Yong Yu, "A Survey on Bid Optimization in Real-Time Bidding Display Advertising," *ACM Transactions on Knowledge Discovery from Data*, Vol. 18, No. 3, 2023, pp. 58:1-31 at p. 58:23-25.

<sup>396</sup> Weitong Ou, Bo Chen, Xinyi Dai, Weinan Zhang, Weiwen Liu, Ruiming Tang, and Yong Yu, "A Survey on Bid Optimization in Real-Time Bidding Display Advertising," *ACM Transactions on Knowledge Discovery from Data*, Vol. 18, No. 3, 2023, pp. 58:1-31 at p. 58:25.

<sup>397</sup> Niklas Karlsson, and Qian Sang, "Adaptive Bid Shading Optimization of First-Price Ad Inventory," *2021 American Control Conference (ACC)*, 2021, pp. 4983-4990 at p. 4983.

what could be achieved with a more sophisticated tool.<sup>398</sup> For example, academic studies have noted that optimizing reserve prices in real-time bidding auctions can significantly improve publisher revenue. A study by Choi and Mela (2023) examined how publishers should set optimal reserve prices in display advertising auctions. The researchers developed a model that accounts for advertisers' minimum impression constraints and found that optimizing reserve prices led to increased revenue of up to 35% compared to using no reserve price or a fixed reserve price.<sup>399</sup> Another study proposed a new approach to determining reserve-price strategies for publishers, focusing not only on the profits from individual ad impressions, but also on maximum coverage of advertising space.<sup>400</sup> This strategy combines the heuristics developed by real-time bidding practitioners with machine learning forecasting algorithms.<sup>401</sup> Other academic studies have incorporated knowledge about the rules of second-price auctions into a framework for optimizing reserve prices, motivated by the real-life practice of small and medium-sized web publishers.<sup>402</sup>

141. Evidence in this case supports these benefits: [REDACTED]

[REDACTED] 403 [REDACTED]

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<sup>398</sup> Anete Jodzevica, "CPM Meaning – What is CPM in Marketing and Advertising?" Setupad, April 12, 2024, available at <https://setupad.com/blog/what-is-cpm/> ("Programmatic advertising combined with a CPM model offers publishers significant benefits. [...] This system also optimizes ad inventory utilization, ensuring minimal unsold space, and provides targeted advertising based on sophisticated audience data, which can improve engagement and the value of ad spaces.").

<sup>399</sup> Hana Choi, and Carl F. Mela, "Optimizing Reserve Prices in Display Advertising Auctions," Working Paper, January 2, 2023, available at [https://hanachoi.github.io/research-papers/choi\\_mela\\_optimal\\_reserve.pdf](https://hanachoi.github.io/research-papers/choi_mela_optimal_reserve.pdf), at "Abstract," pp. 19, 34.

<sup>400</sup> Andrzej Wodecki, "The Reserve Price Optimization for Publishers on Real-Time Bidding on-Line Marketplaces with Time-Series Forecasting," *Foundations of Management*, Vol. 12, No. 1, 2020, pp. 167-180 at p. 167.

<sup>401</sup> Andrzej Wodecki, "The Reserve Price Optimization for Publishers on Real-Time Bidding on-Line Marketplaces with Time-Series Forecasting," *Foundations of Management*, Vol. 12, No. 1, 2020, pp. 167-180 at p. 167.

<sup>402</sup> Jason Rhuggenaath, Alp Akcay, Yingqian Zhang, and Uzay Kaymak, "Setting Reserve Prices in Second-Price Auctions with Unobserved Bids," *INFORMS Journal on Computing*, Vol. 34, No. 6, 2022, pp. 2950-2967 at p. 2950.

403 [REDACTED]

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[REDACTED]

[REDACTED] 404 [REDACTED]

[REDACTED]<sup>405</sup> As a specific example, Facebook Ads optimization “focus[es] on

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[REDACTED]

404 [REDACTED]

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targeting adjustments, bid strategies, and delivery optimizations that aim to improve ad relevance, audience engagement, and the campaign’s cost efficiency.”<sup>406</sup>

142. Given the benefits of optimizations, it is unsurprising it has become industry standard for ad tech providers like Google, Microsoft (Xandr), Meta, Amazon, The Trade Desk, and other programmatic advertising platforms to use sophisticated algorithms to optimize the selection of price floors for publishers.

- Google’s Reserve Price Optimization feature was designed to increase reserve prices in AdX auctions when doing so “increase[ed] publisher yield.”<sup>407</sup> Additionally, Google offers a way to “leverage Google’s machine learning expertise to automatically set floor prices per-query that maximize yield while protecting long-term inventory value.”<sup>408</sup>
- Microsoft’s Xandr Monetize SSP has a “floor optimization” feature that “adjusts the hard floor for every impression to better protect and value a seller’s inventory.”<sup>409</sup> [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] <sup>410</sup> [REDACTED]

[REDACTED]

[REDACTED] <sup>411</sup> [REDACTED]

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<sup>406</sup> Elena Mazaheri, “How to optimize your Facebook Ads: The ultimate guide,” *LeadsBridge*, November 22, 2023, available at <https://leadsbridge.com/blog/how-to-optimize-facebook-ads/>; “Optimizing Your Facebook Ad: Delivery and Placements,” *AdEspresso*, available at <https://adespresso.com/guides/facebook-ads-optimization/delivery-placements/>.

<sup>407</sup> GOOG-DOJ-04937154 at 155.

<sup>408</sup> “Optimize floor prices in unified pricing rules (Beta),” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/11385824?hl=en>.

<sup>409</sup> “Floor optimization,” *Xandr Platform*, March 2, 2024, available at <https://learn.microsoft.com/en-us/xandr/monetize/floor-optimization>.

<sup>410</sup> [REDACTED]

<sup>411</sup> [REDACTED]



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- PubMatic also has “dynamic floor” optimizations.<sup>412</sup> And in 2017, PubMatic stated that “dynamic floors help to protect the value of a publisher’s inventory” and “have become relatively common across all major SSPs [(supply-side platforms)].”<sup>413</sup>
- Prebid, the open-source header bidding solution, allows publishers to “configure Dynamic floors.”<sup>414</sup>

- [REDACTED]  
[REDACTED]  
[REDACTED]<sup>415</sup>
- [REDACTED]  
[REDACTED]  
[REDACTED]<sup>416</sup>
- [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]<sup>417</sup>
- [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]<sup>418</sup>

<sup>412</sup> One of PubMatic’s key capabilities it offers to its publisher customers is “dynamic floors.” See “The Future of Monetization. Built for you.” *PubMatic*, available at <https://pubmatic.com/solutions/publishers/>.

<sup>413</sup> “Understanding Auction Dynamics: A Primer,” *PubMatic*, 2017, available at <https://pubmatic.com/wp-content/uploads/2017/08/PubMatic-UnderstandingAuctionDynamics.pdf>.

<sup>414</sup> “Price Floors Module,” *Prebid*, available at <https://docs.prebid.org/dev-docs/modules/floors.html>. See also Priyanka, “How to Optimize Your Prebid Revenue with Dynamic Flooring?” *Mile*, April 29, 2024, available at <https://www.mile.tech/blog/how-to-optimize-your-prebid-revenue-with-dynamic-flooring>.

<sup>415</sup> [REDACTED]

<sup>416</sup> [REDACTED]

<sup>417</sup> [REDACTED]  
[REDACTED]

<sup>418</sup> [REDACTED]

- [REDACTED]  
[REDACTED].<sup>419</sup>

143. Like dynamic price floors on the sell side, ad tech providers have also implemented buy-side optimizations, such as bid shading algorithms that optimize buyers' bids based on historical and predictive information.<sup>420</sup> For example:

- The Trade Desk advertises that its Predictive Clearing functionality “analyzes historical data” and “makes adjustments to see if [advertisers] can still win the auction with a lower CPM than what [they] originally bid.”<sup>421</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED].<sup>422</sup>
- [REDACTED]  
[REDACTED]  
[REDACTED].<sup>423</sup>

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<sup>419</sup> [REDACTED]

<sup>420</sup> Sarah Sluis, “Everything You Need To Know About Bid Shading,” *AdExchanger*, March 15, 2019, available at <https://www.adexchanger.com/online-advertising/everything-you-need-to-know-about-bid-shading/>; Brock Munro, “Your Guide to Bid shading,” *Publift*, June 27, 2024, available at <https://www.publift.com/blog/your-guide-to-bid-shading>.

<sup>421</sup> “Predictive Clearing: Win More Impressions with Lower CPMs,” *The Trade Desk Partner Portal*, available at <https://partner.thetradedesk.com/v3/portal/api/doc/PredictiveClearing>.

<sup>422</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

<sup>423</sup> [REDACTED]  
[REDACTED]  
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- PubMatic employed “its proprietary bid shading technology” by leveraging “machine learning to improve the overall win rate in the wrapper auction while reducing bid price for DSPs.”<sup>427</sup> And in 2018, PubMatic indicated that its “partners [were] already utilizing this technology with success.”<sup>428</sup>

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[REDACTED]

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[REDACTED]

<sup>427</sup> Kyle Dozeman, “First-Price Auctions: Reviving Control In Auction Dynamics,” *PubMatic*, February 1, 2018, available at <https://pubmatic.com/blog/first-price-auctions-auction-dynamics/> (“By providing bid shading for DSPs that request it, PubMatic is helping publishers maintain access to demand while buyers can still access impressions without disruptive fluctuations in pricing.”).

<sup>428</sup> Kyle Dozeman, “First-Price Auctions: Reviving Control In Auction Dynamics,” *PubMatic*, February 1, 2018, available at <https://pubmatic.com/blog/first-price-auctions-auction-dynamics/>.

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- Google’s employs bid-shading algorithm for DV360 advertisers, which “optimizes [...] fixed CPM bids so that [advertisers] win impressions for the lowest price possible.”<sup>429</sup>

144. In my experience, the fact that ad tech tools provide such optimizations is common “industry knowledge.”<sup>430</sup> For example:

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[REDACTED].<sup>431</sup>
- [REDACTED]  
[REDACTED].<sup>432</sup>
- [REDACTED]  
[REDACTED]  
[REDACTED].<sup>433</sup> [REDACTED]  
[REDACTED].<sup>434</sup>

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<sup>429</sup> “Opt out of optimized fixed CPM bidding,” *Display & Video 360 Help*, available at <https://support.google.com/displayvideo/answer/7440660?hl=en> (indicating Google “optimizes your fixed CPM bids so that you’ll win impressions for the lowest price possible.”).

<sup>430</sup> [REDACTED]  
[REDACTED]

<sup>431</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

<sup>432</sup> [REDACTED]  
[REDACTED]  
[REDACTED]

<sup>433</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

<sup>434</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

**C. These optimizations are typically proprietary and not disclosed to third parties.**

145. Plaintiffs’ experts accuse Google of failure to disclose “changes to auction rules” and experiments related to auctions.<sup>435</sup> Plaintiff’s experts fail to acknowledge that Google did indeed disclose its experiments and auction rules,<sup>436</sup> and that any more detailed disclosures by Google or other ad tech providers would run a number of risks.

146. *First*, the algorithms and methods used to create these optimizations are fundamental to the operations of each ad tech provider and are closely guarded proprietary technology and are therefore not disclosed in any detail. For instance, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED].<sup>437</sup> Similarly, [REDACTED]

[REDACTED]

[REDACTED].<sup>438</sup> [REDACTED]

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[REDACTED]  
[REDACTED]  
[REDACTED]

<sup>435</sup> See, e.g., Chandler Report, Section X.C; Andrien Report, ¶ 100.

<sup>436</sup> “Auction Model,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/152039> (Google’s help center disclosure of its auction model, including that “[t]he net bid takes into account Google’s revenue share and reflects auction optimizations,” and that “Ad Manager may run limited experiments designed to optimize the auction,” and describing the types of experiments involved); GOOG-AT-MDL-C-000035250 (an earlier version of the “Auction Model” article with similar language: “DoubleClick Ad Exchange determines the winning bidder based on the highest net bid submitted. Such net bid reflects any adjustments Ad Exchange may, at its discretion, have made to the bid submitted by the buyer for purpose of optimizing the auction. [...] The Google DoubleClick Ad Exchange may run limited experiments designed to optimize the auction.”).

<sup>437</sup> [REDACTED]  
[REDACTED]  
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[REDACTED]  
[REDACTED]

<sup>438</sup> [REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

[REDACTED]

[REDACTED].<sup>439</sup>

147. *Second*, confidentiality not only helps firms to maintain an edge, but also ensures the integrity and efficacy of the ad delivery process. In fact, transparency in auction algorithms could lead to adversarial behavior and exploitation. For instance, advertisers or publishers might game the system by reverse-engineering the algorithms to manipulate bids or floor prices to exploit vulnerabilities, preventing the auction from performing as designed for both buyers and sellers.<sup>440</sup>

148. *Third*, exposing the inner workings of auction algorithms could also make algorithms more susceptible to hacking attempts or other malicious attacks aimed at undermining their integrity. This issue has been discussed in the context of gaming of social media algorithms, where entities engage in coordinated campaigns to manipulate public opinion. Such practices leverage the transparency of how algorithms elevate popular content, using tactics like coordinated sharing or linking to artificially boost content visibility.<sup>441</sup>

#### **D. Advertisers typically rely on ad agencies to determine bidding strategies.**

149. Many advertisers rely on ad agencies to manage their advertising campaigns. These companies use advanced analytics to optimize campaigns and improve return on investment

<sup>439</sup> [REDACTED]

<sup>440</sup> This notion follows what is known as the “AI transparency paradox.” See Andrew Burt, “The AI Transparency Paradox,” *Harvard Business Review*, December 13, 2019, available at <https://hbr.org/2019/12/the-ai-transparency-paradox>.

<sup>441</sup> Jem Bartholomew, “Gaming the algorithm,” *Columbia Journalism Review*, September 19, 2022, available at [https://www.cjr.org/tow\\_center/gaming-the-algorithm-social-media-platforms-control-of-the-public-sphere-has-proved-remarkably-open-to-abuse.php](https://www.cjr.org/tow_center/gaming-the-algorithm-social-media-platforms-control-of-the-public-sphere-has-proved-remarkably-open-to-abuse.php). Academic research has also discussed the benefits of opacity in algorithms citing potential gaming by users that may negatively affect the algorithm’s predictive power. See Qiaochu Wang, Yan Huang, Stefanus Jasin, and Param Vir Singh, “Algorithmic Transparency With Strategic Users,” *Management Science*, Vol. 69, No.4, 2023, pp. 2297-2317.

(ROI). For instance, agencies and consulting companies can create bespoke media plans, automate data analysis, and optimize campaigns.<sup>442</sup>

150. The role of these ad agencies is multifaceted,<sup>443</sup> as they navigate the complex landscape of media planning and buying to enable advertisers to reach their target audience effectively.<sup>444</sup> They also have a deep understanding of various kinds of display ad auctions and transaction mechanisms. They play a crucial role as intermediaries between advertisers and publishers selling ad slots. Their expertise includes developing bidding strategies, which can dramatically increase advertisers' value. An increasing number of advertisers are employing ad agencies to bid on their behalf in ad auctions.<sup>445</sup>

151. In the past two decades, traditional ad agencies evolved significantly in response to changes in the ad tech industry by expanding their services to include programmatic buying of ad inventory from publishers and ad networks. Ad agencies began to offer “agency trading desks,” which were typically sub-teams of ad agencies that had the technical knowledge and capacity to run display ad campaigns in a centralized or quasi-centralized manner.<sup>446, 447</sup> Examples of agency

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<sup>442</sup> Keri S. Bruce, and Erika N. Auger, “How might AI revolutionize the world of media planning and buying?” *ReedSmith*, June 20, 2023, available at <https://www.reedsmith.com/en/perspectives/ai-in-entertainment-and-media/2023/06/how-might-ai-revolutionize-the-world-of-media-planning-and-buying>.

<sup>443</sup> Until recently, the five largest and most established ad agencies worldwide, commonly known as the “Big Five,” consisted of WPP, Omnicom, Publicis, Interpublic Group of Companies (IPG), and Dentsu. *See* Mara Einstein, *Advertising: What Everyone Needs to Know*, Oxford University Press, 2017, at pp. 49-51. More recently, Accenture Interactive grew as the fourth largest media agency by revenue, exceeding that of IPG and Dentsu in 2019. *See* Gideon Spanier, “New Accenture CEO eyes M&A as Interactive revenue hits \$10b,” *PRWeek*, September 30, 2019, available at <https://www.prweek.com/article/1661040/new-accenture-ceo-eyes-m-a-interactive-revenue-hits-10b>.

<sup>444</sup> “What is a Media Agency and what does a Media Agency do?” *One Day Agency*, available at <https://oneday.agency/blog/what-is-a-media-agency>; Stephan Miller, “What Is an Advertising Agency?” *Capterra*, August 17, 2022, available at <https://www.capterra.com/resources/what-is-an-advertising-agency/>.

<sup>445</sup> Yurong Chen, Qian Wang, Zhijian Duan, Haoran Sun, Zhaohua Chen, Xiang Yan, and Xiaotie Deng, “Coordinated Dynamic Bidding in Repeated Second-Price Auctions with Budgets,” *Proceedings of the 40th International Conference on Machine Learning*, 2023, pp. 1-35 at p. 1 (“These agencies are specialized in designing online algorithms and bidding on behalf of their clients.”).

<sup>446</sup> “Agency Trading Desks: Basics Marketers Need to Know & Questions to Ask,” *Association of National Advertisers (ANA)*, November 2011, available at [https://www.adexchanger.com/Agency\\_Trading\\_White\\_Paper.pdf](https://www.adexchanger.com/Agency_Trading_White_Paper.pdf); Ian Simpson, “Complex Relationships in Digital Advertising,” *Clearcode*, December 8, 2023, available at <https://clearcode.cc/blog/digital-advertising-relationships/> (“By 2007-2008, some agencies started creating so-called trading desks, which allowed them to buy digital inventory in bulk and package it up for their clients based on audience data.”).

<sup>447</sup> Different agency trading desks have different practices with regard to actively bidding in display ad auctions versus relying on DSPs for the bidding processes. *See, e.g.*, Shubham Grover, “What are Agency Trading

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trading desks included those established by ad agencies: Xaxis (by WPP),<sup>448</sup> VivaKi (by Publicis),<sup>449</sup> Cadreon (by IPG),<sup>450</sup> and Affiperf (by Havas),<sup>451</sup> and independent trading desks such as Accordant Media.<sup>452</sup>

152. Agency trading desks operate by leveraging data and technology to deliver targeted and relevant ad campaigns to consumers on digital properties. Specifically, agency trading desks analyze data from various sources, including customer demographics, browsing behavior, and other relevant factors, to identify the best target audience for each campaign. Once identified, the agency trading desks use programmatic buying technology to purchase ad space in real or near-real time, optimizing the ad's delivery and targeting.<sup>453</sup> In addition, agency trading desks are also

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Desks?" *AdPushup*, November 14, 2022, available at <https://www.adpushup.com/blog/what-are-agency-trading-desks/> ("Agency trading desks [...] [p]urchase massive quantities of digital inventory, primarily through regulated real-time bidding auctions. [...] The capabilities of an ATD appear similar to the features provided by a self-serve demand-side platform (DSP). The important distinction is that agency trading desks typically provide some additional human labor on top of it."); "Agency Trading Desks: Basics Marketers Need to Know & Questions to Ask," *Association of National Advertisers (ANA)*, November 2011, available at [https://www.adexchanger.com/Agency\\_Trading\\_White\\_Paper.pdf](https://www.adexchanger.com/Agency_Trading_White_Paper.pdf) ("The agency creates a list of attributes that define desired audience behavior and uses a DSP, which has an algorithm and bidding capabilities that can match inventory and audience attributes as well as optimize campaign performance, in real or near-real time."); Michal Wlosik, "What Is an Agency Trading Desk (ATD) and How Does It Work?" *Clearcode*, January 31, 2024, available at <https://clearcode.cc/blog/what-is-an-agency-trading-desk/> ("Some ATDs will purchase media in advance, add a markup and then sell it to their clients at a higher price, whereas others buy media via real-time bidding and take a percentage of the budget. [...] Some of the bigger ATDs were bona-fide tech enterprises that offered services, but many simply outsourced the technology and paid for third-party DSPs.").

<sup>448</sup> "Xaxis Update," *WPP Digital*, 2015, available at [https://www.wpp.com/-/media/project/wpp/files/investors/2015/brian\\_lesser\\_final.pdf?la=en](https://www.wpp.com/-/media/project/wpp/files/investors/2015/brian_lesser_final.pdf?la=en).

<sup>449</sup> "Publicis Groupe Launches VivaKi A New Growth Engine for the New Media and Digital Environment," *Publicis Groupe*, June 25, 2008, available at [https://www.publicisgroupe.com/sites/default/files/press-release/20080625\\_VivaKi\\_EN\\_Final.pdf](https://www.publicisgroupe.com/sites/default/files/press-release/20080625_VivaKi_EN_Final.pdf).

<sup>450</sup> "Ad Exchanges in NY Times; IPG Announces Cadreon; Clickable Optimizes," *AdExchanger*, June 2, 2009, available at <https://www.adexchanger.com/ad-exchange-news/ad-exchanges-new-york-times-ipg-interpublic-group-cadreon-ad-network-clickable/>.

<sup>451</sup> Liz Rowley, "Havas' Hybrid Approach To Programmatic," *AdExchanger*, August 14, 2015, available at <https://www.adexchanger.com/agencies/havas-hybrid-approach-to-programmatic/> ("In 2010, Havas debuted Affiperf, a global trading desk that Havas calls a 'Meta DSP'.").

<sup>452</sup> "Agency Trading Desks: Basics Marketers Need to Know & Questions to Ask," *Association of National Advertisers (ANA)*, November 2011, available at [https://www.adexchanger.com/Agency\\_Trading\\_White\\_Paper.pdf](https://www.adexchanger.com/Agency_Trading_White_Paper.pdf).

<sup>453</sup> MarTech, "Understanding Advertising Technology (AdTech): Definition, Ecosystem, And Programmatic," *PROTEAN STUDIOS*, January 15, 2024, available at <https://proteanstudios.com/advertising-technology-adtech>.



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equipped with advanced performance management and optimization tools, which provide advertisers with richer insights on the effectiveness of their marketing initiatives.<sup>454</sup>

153. As a result, advertisers have been increasingly delegating their bidding tasks to specialized ad agencies.<sup>455</sup> In doing so, advertisers only need to relay their objectives and budget constraints to their ad agencies, who then take these requests and design corresponding online bidding algorithms and bid on behalf of these advertisers.

154. In line with the discussion above, testimony in this case demonstrates that advertisers often rely on ad agencies to manage their ad buying process. For example,

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[REDACTED]  
[REDACTED]  
[REDACTED]<sup>457</sup>

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<sup>454</sup> “Agency Trading Desks: Basics Marketers Need to Know & Questions to Ask,” *Association of National Advertisers (ANA)*, November 2011, available at [https://www.adexchanger.com/Agency\\_Trading\\_White\\_Paper.pdf](https://www.adexchanger.com/Agency_Trading_White_Paper.pdf).

<sup>455</sup> Francesco Decarolis, Maris Goldmanis, and Antonio Penta, “Marketing Agencies and Collusive Bidding in Online Ad Auctions,” *Management Science*, Vol. 66, No. 10, 2020, pp. 4433-4454.

<sup>456</sup> [REDACTED]  
[REDACTED]  
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**E. Publishers typically use experiments, testing, and optimizations to maximize their yield.**

155. While Dr. Chandler opines that Google’s failure to disclose its auction mechanics harmed its customers,<sup>474</sup> the evidence in this case and my experience in the industry suggest that more detailed disclosures of Google’s algorithms would not make a meaningful difference. Rather, publishers use various testing, experimental, and optimization techniques, along with the expertise of third parties, to maximize their revenues from display advertising.<sup>475</sup>

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<sup>474</sup> Chandler Report, ¶ 341.

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156. Publishers expect that the ad tech platforms they use will maximize the revenue potential of their digital properties.<sup>476</sup> They depend on sophisticated ad tech solutions to efficiently manage their ad spaces—optimizing fill rates and maximizing eCPMs (effective cost per thousand impressions).<sup>477</sup> The use of proprietary algorithms facilitates each ad impression being sold at the highest possible price, according to real-time market dynamics and the specific characteristics of the inventory.<sup>478</sup> This expectation of yield optimization is a fundamental aspect of the publisher’s business model in digital media.<sup>479</sup>

157. In particular, optimizing reserve prices—often through dynamic price floors—is critical to publishers’ yield maximization. In an automated auction environment, supply-side platforms (SSPs) increase publishers’ yield with the use of features like dynamic floor pricing to ensure that DSPs pass along their best bids into auctions.<sup>480</sup> I discuss examples of dynamic floor pricing optimizations in **Section V.B.**

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<sup>476</sup> “What is AdTech? Basics of The Ad Tech Ecosystem Explained,” *AdButler*, May 5, 2021, available at <https://www.adbutler.com/blog/article/what-is-ad-tech-the-ad-tech-ecosystem-explained> (“For publishers, an ad tech stack involves selecting tools that optimise ad revenue[.]”); “Mastering Supply Side Platform in 2023: Overview, Benefits, and Best Practices for Maximizing Revenue,” *Start.io*, June 22, 2023, available at <https://www.start.io/blog/mastering-supply-side-platform-overview-benefits-and-best-practices-for-maximizing-revenue/> (“SSPs help publishers optimize yield from their ad inventory by hugely broadening the advertiser pool.”).

<sup>477</sup> Alise Zaiceva, “eCPM, rCPM and Fill Rate | Important Monetization Metrics,” *Setupad Blog*, April 14, 2022, available at <https://setupad.com/blog/ecpm-rcpm-and-fill-rate/>.

<sup>478</sup> For instance, a news website with high-traffic volumes during a major event would expect its ad tech provider to leverage these periods of high demand to increase ad revenue through dynamic pricing models.

<sup>479</sup> Brock Munro, “Effective Yield Optimization for Publishers,” *Publift*, June 28, 2024, available at <https://www.publift.com/blog/effective-yield-optimization-for-publishers> (“Yield optimization is a necessary initiative to ensure the space publishers dedicate to ads on their website is generating maximum revenue.”).

<sup>480</sup> Eric Picard, “Publishers, Don’t Settle for Below-Floor Pricing,” *AdExchanger*, November 1, 2023, available at <https://www.adexchanger.com/the-sell-sider/publishers-dont-settle-for-below-floor-pricing/> (“Supply-side platforms (SSPs) were born to protect publishers’ interests in an automated auction environment. They introduced features like dynamic floor pricing to ensure that demand-side platforms (DSPs) pass on their best bids into the auction.”).

158. In addition to relying on their ad tech providers' floor price optimizations, Publishers can also test the outcomes of different floors to determine how best to optimize their revenue. For example,

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159. Publishers can also conduct other kinds of testing to determine the configurations to maximize their revenues.<sup>484</sup> Publisher testing can compare ad unit locations, sizes (*e.g.*, 300×250 versus 300×600), formats (*e.g.*, static display ads versus video display ads), and layouts on their websites, apps, and other properties to find the optimal configuration that maximizes revenue

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while maintaining a good user experience.<sup>485</sup> <sup>486</sup> Other techniques include frequency capping tests, optimizing geographic targeting, and other targeting parameters.<sup>487</sup>

160. Companies like Google enable publisher experiments and testing to find configurations that work best for their specific goals.<sup>488</sup> [REDACTED]

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161. Moreover, many publishers, like advertisers, have the option to rely on the expertise of consultants and other third parties to maximize their revenues. For example,

- Verve Group, a third-party monetization platform, helps publishers maximize their ad revenue (with maximum fill rates and higher CPMs) through the use of privacy-focused

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<sup>485</sup> Karina Julio, “A/B testing for publishers: 6 ideas for programmatic and UX optimization,” *Assertive Yield*, available at <https://www.assertiveyield.com/blog/ab-testing-publishers/>.

<sup>486</sup> Brock Munro, “Effective Yield Optimization for Publishers,” *Publift*, June 28, 2024, available at <https://www.publift.com/blog/effective-yield-optimization-for-publishers>.

<sup>487</sup> Brock Munro, “Effective Yield Optimization for Publishers,” *Publift*, June 28, 2024, available at <https://www.publift.com/blog/effective-yield-optimization-for-publishers>.

<sup>488</sup> GOOG-AT-MDL-007177040 (Deposition of [REDACTED], *In Re Google Antitrust Litigation*, July 22, 2021) at 294:24-295:11 (describing Google feature that enabled publishers to “conduct experiments...with the idea of improving monetization”); [REDACTED]

[REDACTED]; “Maximize your revenue with Opportunities and Experiments,” *Google Ad Manager*, available at [https://admanager.google.com/home/resources/feature\\_brief\\_opportunities\\_and\\_experiments/](https://admanager.google.com/home/resources/feature_brief_opportunities_and_experiments/).

<sup>489</sup> [REDACTED]

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targeting solutions, improved ad quality, and access to “85+ DSPs and 5,000+ advertisers and brands.”<sup>490</sup>

- Maxifier, a third-party monetization platform, provides several solutions to publishers to increase their revenue, including campaign performance predictions, performance optimization based on various metrics, simulation, and testing of potential campaign changes before implementation, and automation of optimization processes.<sup>491</sup>
- MonetizeMore, a third-party monetization platform, offers optimization for AdX and AdSense, customized programmatic ad revenue solutions for publishers, and “discrepancy and optimization opportunities with consolidated data across ad networks.”<sup>492</sup>
- Inventale, a third-party forecasting platform available “for publishers, advertising agencies, SSP[s] and DSP[s],” provides publishers with ad inventory forecasting, ad network monitoring, and yield management.<sup>493</sup>
- Clickio, a third-party monetization platform, offers automated price floor optimization to boost publishers’ earnings, and automated mediation for publishers using Google AdSense to “guarantee maximum revenues.”<sup>494</sup>
- Adomik, a third-party revenue management platform, allows publishers to “collect and organize revenue data from ad servers, ad exchanges, and header bidding partners” to optimize their yield.<sup>495</sup>

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<sup>490</sup> “Make every user worth more,” *Verve*, available at <https://verve.com/publishers/>; [REDACTED]

<sup>491</sup> “Maxifier for Publishers,” *Maxifier*, available at <https://maxifier.com/maxifier-for-publishers/>.

<sup>492</sup> “Maximize your ad revenue, prevent invalid traffic, and gain actionable insights, all in one place.” *MonetizeMore*, available at <https://www.monetizemore.com/solutions/>.

<sup>493</sup> “BURT Forecasting Platform,” *Burt Forecasting*, available at <https://inventale.com/en/>.

<sup>494</sup> “Maximize Revenue, Minimize Hassle,” *Clickio*, available at <https://clickio.com/monetization/>.

<sup>495</sup> “Smart Advertising Analytics: To turn insights into revenue,” *Adomik*, available at <https://www.adomik.com/>.

**VI. PLAINTIFFS’ EXPERTS MAKE INTERNALLY-INCONSISTENT STATEMENTS ABOUT ACCESS TO DATA THAT DO NOT REFLECT REALITY.**

162. While asserting that “Google’s scale advantage in the digital advertising ecosystem is formidable, primarily due to its vast reach and extensive first-party data,”<sup>496</sup> Dr. Chandler also acknowledges that “[b]y collaborating with data providers and integrating data from various sources, [Google’s competitors] can build comprehensive user profiles that rival those created with Google’s first-party data.”<sup>497</sup> As I discuss in more detail in **Section VI.A**, below, there are many competitors—such as Amazon, Meta, Disney, Microsoft, Comcast, The Trade Desk, Walmart, and others—that process large volumes of transactions and benefit from scaled data today, and as Dr. Chandler recognizes, advertisers and publishers have access to and combine data from a variety of sources for effective ad targeting.

163. Nonetheless, Professor Gans claims that data is a barrier to entry.<sup>498</sup> But both he and Dr. Chandler recognize that extensive first-party data is not necessary, admitting that “advanced algorithms and machine learning techniques for probabilistic matching [...] can improve match rates and targeting accuracy even without extensive first-party data.”<sup>499</sup> As I describe in **Section VI.B**, below, while having scaled data can be a benefit, it is not a substantial barrier to entry and there are diminishing returns to having more data. That is why many competitors, including The Trade Desk and TikTok, have entered and have grown quickly to become competitors despite launching without access to significant quantities of data. Indeed, the number of ad exchanges has increased since 2010, from about ten to over 50 ad exchanges today.<sup>500</sup>

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<sup>496</sup> Chandler Report, ¶ 28.

<sup>497</sup> Chandler Report, ¶ 285.

<sup>498</sup> Gans Report, Section V.C.3 (“Google’s data advantage is a barrier to entry.”).

<sup>499</sup> Chandler Report, ¶ 285 (emphasis added); Gans Report, ¶ 331 (“While having a comprehensive portfolio on a user is desirable for securing high-quality matches, in many cases, such comprehensive data is not available. To close this gap, advertising platforms have become increasingly sophisticated in using statistical techniques utilizing machine learning – commonly known as artificial intelligence – to use data from large numbers of users to predict the purchase intent of any given user.”).

<sup>500</sup> GOOG-AT-MDL-015269020 at 042, 050 (2010 document listing 10 ad exchanges); GOOG-DOJ-AT-00581461 at 463 (2021 document referencing “~50” ad exchanges); “Supported display exchanges,” *Display & Video 360 Help*, available at <https://support.google.com/displayvideo/table/3267029?hl=en> (listing over 100 exchanges);

164. And finally, while Dr. Chandler opines that Google’s plan to deprecate third-party cookies in Chrome is “concerning to competing display advertising tools and to publishers and advertisers,”<sup>501</sup> he also recognizes that “third-party cookie data does raise certain privacy concerns[.]”<sup>502</sup> Indeed, and as I discuss in **Section VI.C**, Google’s now-defunct plan to deprecate third-party cookies came at a time of increasing regulatory and consumer focus on privacy. As a result, Google has been part of an industry-wide trend of developing solutions to preserve the significant benefits of targeted advertising for users, advertisers, and publishers, while also protecting users’ privacy.

**A. Advertisers, publishers, and other firms in display advertising—including Google’s competitors—have access to scaled user data that facilitate ad targeting.**

165. Plaintiffs’ experts contend that Google has access to large volumes of user data that put its competitors with less data at a substantial disadvantage,<sup>503</sup> but they fail to recognize that there are many competitors in display advertising that also have access to large volumes of similar data. Furthermore, and as Plaintiffs’ experts recognize, Google’s access to data does not preclude others from having similar data, too.

166. The goal of targeted advertising is to put the “right” advertisement in front of the “right” user at the “right” time at the “right” place.<sup>504</sup> Advertisers prefer to show ads to people who are more likely to be interested in their product, and do so by targeting users with their ads. And consumers prefer to be served ads that are likely to be relevant to them.

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“Supported native exchanges,” *Display & Video 360 Help*, available at <https://support.google.com/displayvideo/table/7181360?hl=en> (listing 28 exchanges); “Supported audio & video exchanges,” *Display & Video 360 Help*, available at <https://support.google.com/displayvideo/table/6275132?hl=en> (listing 95 exchanges).

<sup>501</sup> Chandler Report, ¶ 291.

<sup>502</sup> Chandler Report, ¶ 287.

<sup>503</sup> Chandler Report, ¶¶ 284-285; Gans Report, ¶ 363.

<sup>504</sup> Deng Yuanyuan, “Big data’s pursuit of the perfectly tailored ad: An Interview with Anindya Ghose,” *CKGSB Knowledge*, October 18, 2016, available at <https://english.ckgsb.edu.cn/knowledge/article/big-datas-pursuit-of-the-perfectly-tailored-ad-an-interview-with-anindya-ghose/> (“give them the coupon at the right time, at the right place and the right location[.]”).

167. Targeted advertising is not a new strategy—advertisers have long attempted to reach users who are more interested in their message by advertising in publications containing content relevant to their message (*e.g.*, sellers of outdoor equipment often advertise in magazines focused on outdoor activities). Traditional media advertisers relied largely on demographic factors such as age, gender, and geographic location to reach their target audience.<sup>505</sup> Ad tech for digital content has significantly improved the ability of advertisers to target their advertisements to users who are likely to be interested in their products. The digital context has enabled advertisers to also collect certain kinds of data about individuals’ online behaviors, preferences, and interests.<sup>506</sup> This level of granularity of the data allows for more effective and efficient ad campaigns, maximizing the likelihood of reaching the right audience with the right message at the right time.<sup>507</sup>

168. Plaintiffs’ experts’ emphasis on their alleged “open web display” market leads them to overlook that many users “multi-home”—that is, they use multiple services at once.<sup>508</sup> Users are rarely captured exclusively by one digital platform or service. For example, on any given day, a single user might spend time with services provided by Meta (including Facebook and Instagram), Microsoft (including LinkedIn), TikTok, X (formerly Twitter), Amazon, Walmart,

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<sup>505</sup> Alexandra Samuel, “Psychographics Are Just as Important for Marketers as Demographics,” *Harvard Business Review*, March 11, 2016, available at <https://hbr.org/2016/03/psychographics-are-just-as-important-for-marketers-as-demographics> (“Marketers are used to thinking and speaking in demographics, since slicing a market up by age, gender, ethnicity and other broad variables can help to understand the differences and commonalities among customers.”); Simon P. Anderson, and Jean J. Gabszewicz, “The Media and Advertising: A Tale of Two-Sided Markets,” Chapter 18 in *Handbook of the Economics of Art and Culture*, Vol. 1, 2006, pp. 567-614 at p. 568 (“Competition for viewers of the demographics most desired by advertisers implies that programming choices will be biased towards the tastes of those with such demographics.”).

<sup>506</sup> Maciej Zawadziński, and Mike Sweeney, “AdTech Targeting Methods: The Ultimate Guide,” *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/adtech-targeting-guide/>.

<sup>507</sup> “Winning the Moments that Matter: Right Person, Right Message, Right Time, Every Time,” *Think with Google*, September 2015, available at <https://www.thinkwithgoogle.com/intl/en-gb/consumer-insights/consumer-trends/winning-the-moments-that-matter-right-person/>; Brad Jones, “Making ‘right audience, right message, right time’ a reality,” *BAI*, August 24, 2016, available at <https://www.bai.org/banking-strategies/making-right-audience-right-message-right-time-a-reality/>.

<sup>508</sup> Marco Iansiti, “Assessing the Strength of Network Effects in Social Network Platforms,” Harvard Business School Working Paper, No. 21-086, 2021, available at [https://www.hbs.edu/ris/Publication%20Files/21-086\\_a5189999-6335-4890-b050-a59a4b665198.pdf](https://www.hbs.edu/ris/Publication%20Files/21-086_a5189999-6335-4890-b050-a59a4b665198.pdf), at p. 6 (“Multi-homing is incredibly common in social media, and users face little friction in doing so (Schmalensee, 2011, Mital and Sarkar, 2011, Hagiu 2010). This is especially true given social media platforms are typically free. The ease of multihoming allows users to easily get exposure to competing platforms and either divide their use or switch platforms entirely.”), p. 9 (“[B]etween 2013 and 2017, the average number of social accounts held by global internet users almost doubled, from 4.3 to 7.6 (Valentine 2017).”).

Target, Disney, Netflix, and many other firms. Indeed the average U.S. adult smartphone consumer uses 46 different apps in a month,<sup>509</sup> and more than seven “social media” apps.<sup>510</sup> Academic research confirms that the significant extent of multi-homing in social networking apps is widely recognized.<sup>511</sup> Given the high frequency of user multi-homing, an advertiser can reach the same user through multiple different digital platforms using data the advertiser already possesses, such as consumer email addresses, phone numbers, and browsing activity.<sup>512</sup> If an advertiser wanted to reach John Doe or target a segment to which he might belong (such as “outdoorsy dad who likes mountaineering”), then the advertiser can specify either his identity or his segment characteristics and reach him on multiple digital platforms, using data from the advertiser’s business or from third-party data providers, such as data management platforms, for

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<sup>509</sup> Stephanie Chan, “U.S. Consumers Used an Average of 46 Apps Each Month in the First Half of 2021,” *Sensor Tower*, August 2021, available at <https://sensortower.com/blog/apps-used-per-us-smartphone>.

<sup>510</sup> Belle Wong, “Top Social Media Statistics And Trends Of 2024,” *Forbes*, May 18, 2023, available at <https://www.forbes.com/advisor/business/social-media-statistics/>.

<sup>511</sup> Harmanpreet Kaur, Cliff Lampe, Isaac Johnson, Brent Hecht, Hannah J. Miller, Walter S. Lasecki, and Loren G. Terveen, “Oh The Places You’ll Share: An Affordances-Based Model of Social Media Posting Behaviors,” *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*, 2018, at pp. 1-2 (“Many people now use multiple social network sites (SNSs) instead of just one. According to the latest report by Pew Research Center, 56% of online adults use more than one of the following SNSs: Facebook, Twitter, Instagram, Pinterest, and LinkedIn [...].”); Xuan Zhao, Cliff Lampe, and Nicole B. Ellison, “The Social Media Ecology: User Perceptions, Strategies and Challenges,” *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, 2016, pp. 89-100 at p. 94 (“[P]articipants reached their desired audience by sharing the same content over multiple platforms.”).

<sup>512</sup> “About customer list custom audiences,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/341425252616329?id=2469097953376494> (“A custom audience made from a customer list is a type of audience you can create to connect with people who have already shown an interest in your business or product. It’s made of information – called ‘identifiers’ – you’ve collected about your customers (such as email, phone number and address) and provided to Meta.”); “Custom Audiences,” *Oracle*, available at <https://docs.oracle.com/cloud/social/doc.1/srm/vitruue-srm-settings/custom-audiences.html> (“Facebook’s Custom Audience system allows you to match your customer lists to Facebook users, opening you to social marketing opportunities you may not have had before.”); “About Customer Match,” *Google Ads Help*, available at <https://support.google.com/googleads/answer/6379332?sjid=12834180832130942526-NA> (“Customer Match lets you use your online and offline data to reach and re-engage with your customers across Search, the Shopping tab, Gmail, YouTube, and Display. Using information that your customers have shared with you, Customer Match will target ads to those customers and other customers like them.”); “Matched Audiences,” *LinkedIn*, available at <https://business.linkedin.com/marketing-solutions/ad-targeting/matched-audiences> (“Market to prospects and known contacts by securely uploading your list of contact IDs or connecting to your contact management platform”); “List Custom Audiences,” *X Business*, available at <https://business.x.com/en/help/campaign-setup/campaign-targeting/custom-audiences/lists.html> (“List Custom Audiences allow advertisers to create Customer Audience segments by uploading lists that contain customer & user data (1P or 3P).”).

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example.<sup>513</sup> If advertisers have relatively less success advertising on Google, they can shift to alternative platforms such as Facebook to reach that set of users using similar tools for creating custom audiences.<sup>514</sup>

169. Companies with rich first-party data about their users (including social media platforms, news media companies, and retailers) have put that advantage to use in their advertising efforts. For example, retailers such as Amazon and Walmart have accumulated data on consumer browsing and purchasing behavior, which can be used to effectively target ads.<sup>515</sup> Similarly, social media companies such as Meta and TikTok have accumulated data on user connections, preferences, and interests, which can be used to effectively target ads.<sup>516</sup> TikTok only introduced ads in 2019,<sup>517</sup> yet earned an estimated \$10 billion in ad revenue in 2022, surpassing competitors

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<sup>513</sup> Maciej Zawadziński, and Mike Sweeney, “What is a Data Management Platform (DMP) and How Does it Work?” *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/data-management-platforms/> (“One of the main use cases of a DMP is to help advertisers improve the performance of their online media campaigns. The way they do this is by integrating with a DSP. Then, the DSP and DMP sync cookies together, allowing the DMP and DSP to identify users across different websites and mobile apps.”).

<sup>514</sup> Dan Golden, “The Art Of The Shift: When To Optimize Or Shift Your Digital Marketing Investment,” *Forbes*, February 6, 2017, available at <https://www.forbes.com/sites/forbesagencycouncil/2017/02/06/the-art-of-the-shift-when-to-optimize-or-shift-your-digital-marketing-investment/>.

<sup>515</sup> “Inform your strategy with customer insights,” *Amazon*, available at <https://sell.amazon.com/tools/amazon-brand-analytics>; Joan Flanagan, “Announcing In-Market Targeting: A new tactic to target customers who are ready to buy now,” *Walmart Connect*, June 29, 2021, available at <https://www.walmartconnect.com/announcing-in-market-targeting--a-new-tactic-to-target-customers>.

<sup>516</sup> “About detailed targeting,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/182371508761821?id=176276233019487>; “About Interest Targeting,” *TikTok Business Help Center*, May 2024, available at <https://ads.tiktok.com/help/article/interest-targeting?lang=en>.

<sup>517</sup> “TikTok is quietly testing ads,” *Digiday*, January 29, 2019, available at <https://digiday.com/marketing/tiktok-quietly-testing-ads/> (“Less than six months into its launch, TikTok has quietly introduced an ad unit. On Jan[.] 26, the short-form video app that combined with Musical.ly last August showed an app install ad from food delivery company GrubHub.”).



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such as X and Snapchat.<sup>518</sup> Advertisers are continuing to shift to TikTok as it grows in popularity<sup>519</sup> and, thus, becomes a valuable source of several categories of first-party data.<sup>520</sup>

170. Various companies have used their first-party data to improve targeting and generate advertising revenue. For example, within The New York Times, digital ads that use their first-party data accounted for more than 20% of the company's core ad revenue in Q4 of 2020.<sup>521</sup> The Washington Post developed a first-party data-based tool called Washington Post Signal, which combines detailed consumption data from their digital subscribers and registered users with contextual ad targeting capabilities to ensure more accurate ad delivery.<sup>522</sup> The Guardian reported a 65% higher-than-average brand lift when using its first-party data.<sup>523</sup>

171. As described above in **Section III**, many of the largest firms in display advertising offer advertisers the ability not only to buy display ad space on their owned-and-operated properties

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<sup>518</sup> Kalley Huang, Isabella Simonetti, and Tiffany Hsu, "TikTok Builds Itself Into an Ads Juggernaut," *The New York Times*, November 14, 2022, available at <https://www.nytimes.com/2022/11/14/technology/tiktok-ads-social-media.html> ("This year, TikTok is on track to make nearly \$10 billion in ad revenue, more than double what it generated last year, according to estimates from the research company Insider Intelligence. TikTok's ad revenue this year is expected to eclipse that of rivals like Twitter and Snap, although its business remains small compared with Google and Meta, which owns Facebook and Instagram."); Bhanvi Satija, "TikTok's ad revenue to surpass Twitter and Snapchat combined in 2022 - report," *Reuters*, April 11, 2022, available at <https://www.reuters.com/technology/tiktoks-ad-revenue-surpass-twitter-snapchat-combined-2022-report-2022-04-11/> ("Twitter and Snapchat are expected to generate \$5.58 billion and \$4.86 billion, respectively, in advertising revenue for 2022, with the combined value still less than the \$11 billion projected for TikTok.").

<sup>519</sup> Krystal Scanlon, "Prioritizing TikTok, agencies move away from creating content for Instagram, YouTube," *Digiday*, October 24, 2022, available at <https://digiday.com/marketing/agencies-move-away-from-creating-content-for-instagram-youtube-to-prioritize-tiktok/> ("Gone are the days when TikTok campaigns were reshaped versions of content that had already been published on Facebook or Instagram. Instead, marketers are increasingly prioritizing putting content on TikTok as they chase the app's large, growing – and younger – audience.").

<sup>520</sup> Eray Eliaçik, "Explained: What data does TikTok collect?" *Ghacks*, March 28, 2023, available at <https://www.ghacks.net/2023/03/28/explained-what-data-does-tiktok-collect/>; Kateryna Hanko, "TikTok Data Collection: What It Knows and Shares About Users," *Clario*, November 18, 2022, available at <https://clario.co/blog/tiktok-data/>.

<sup>521</sup> Sarah Sluis, "First-Party Data Delivers 20% Of New York Times' Digital Ad Revenue," *AdExchanger*, February 4, 2021, available at <https://www.adexchanger.com/publishers/first-party-data-delivers-20-of-new-york-times-digital-ad-revenue/>.

<sup>522</sup> Jarrod Dicker, "Jarrod Dicker: The brand-publisher relationship is not just about context, it's also about consumption," *The Washington Post*, November 3, 2020, available at <https://www.washingtonpost.com/pr/2020/11/03/jarrod-dicker-brand-publisher-relationship-is-not-just-about-context-its-also-about-consumption/>.

<sup>523</sup> Julie Vuibert, "How Publishers' First-Party Data is Reshaping Advertising," *State Of Digital Publishing*, March 11, 2022, available at <https://www.stateofdigitalpublishing.com/opinion/first-party-data-is-reshaping-advertising/>.



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but also on third-party publisher properties, often with targeting capabilities that leverage these companies' first-party data:

- a. For example, Meta offers advertisers this capability through its Meta Audience Network (which leverages Meta's user targeting capabilities from its owned-and-operated properties);<sup>524</sup>
- b. Microsoft offers advertisers this capability through its Microsoft Audience Network<sup>525</sup> and its Xandr business;<sup>526</sup>
- c. Amazon offers this capability through its Amazon DSP (which leverages Amazon's shopping insights from its owned-and-operated properties);<sup>527</sup>
- d. Walmart offers this capability through its DSP;<sup>528</sup>
- e. Comcast offers this capability through FreeWheel;<sup>529</sup> and

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<sup>524</sup> "Better Targeting = Better Experience," *Meta for Developers*, available at <https://developers.facebook.com/docs/audience-network/targeting/> ("Advertisers can opt their campaigns into the Audience Network with a single click. When an advertiser opts their campaign into the Audience Network, all of the same targeting applies to their ads, on Facebook or in third-party apps. This works because when you send us an ad request, we match that user to a Facebook user using the device ID or advertising ID from their device. Once we have identified the user, we are able to show them an ad similar to one they would have seen on Facebook.").

<sup>525</sup> Mallory Harwood, "10 reasons why the Microsoft Audience Network is a must-buy," *Microsoft Advertising Blog*, June 30, 2022, available at <https://about.ads.microsoft.com/en-us/blog/post/june-2022/10-reasons-why-the-microsoft-audience-network-is-a-must-buy> ("There are many advantages to partnering with an industry-trusted partner like Microsoft Advertising. Still, none are more significant than access to our first-party proprietary data—which nobody else can claim.").

<sup>526</sup> "Microsoft Invest," *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en-us/solutions/xandr/xandr-premium-programmatic-advertising> (noting that Microsoft Invest is "powered by Xandr").

<sup>527</sup> "Amazon DSP: Your brand in new places," *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/amazon-dsp> ("Use exclusive insights and shopping signals to connect with the most relevant audiences anywhere they spend their time.").

<sup>528</sup> Rich Lehrfeld, "Walmart Connect Launches Its New Demand-Side Platform, Walmart DSP, To Expand Its Off-Site Media Offerings at Scale," *Walmart*, August 25, 2021, available at <https://corporate.walmart.com/news/2021/08/25/walmart-connect-launches-its-new-demand-side-platform-walmart-dsp-to-expand-its-off-site-media-offerings-at-scale> ("Reach specific audiences with increased precision by leveraging Walmart's past purchase and predictive audience segments, as well as brand level shopping behavior data from across the entire Walmart ecosystem, including our website, app and our 4,700 physical stores.").

<sup>529</sup> "Beeswax Natively Integrates Advanced Access to FreeWheel's Premium CTV Marketplace," *FreeWheel*, available at <https://www.freewheel.com/insights/blog/beeswax-integrates-access-to-freewheel> ("We use technology, data, and premium inventory to enable buyers and sellers to transact across all screens, data types, and sales channels to achieve results for marketers.").

f. Yahoo offers this capability through its Yahoo DSP.<sup>530</sup>

172. Competitors without direct relationships with internet users, such as The Trade Desk (which has a market capitalization of over \$46 billion as of July 2024<sup>531</sup>), also have developed strong targeting capabilities, Google’s documents describe The Trade Desk as having “stronger [...] targeting” than Google’s own DV360.<sup>532</sup>

173. Indeed, companies like The Trade Desk have developed targeting capabilities because data is “non-rivalrous” (*i.e.*, one firm’s accumulation of data does not reduce the availability of the same data to a competing firm).<sup>533</sup> Professor Gans agrees with this when he notes that “[d]ata [...] is what economists term a ‘non-rival’ good. This means that if one firm or platform uses user data, another firm or platform can use the same data.”<sup>534</sup> Data are available to advertisers, publishers, and ad tech companies through a variety of methods, including cookies, data brokers, data management platforms (DMPs), and other sources that I describe below. If Google knows that John Doe is male, married, and likes mountaineering, Meta, Amazon, TikTok, Pinterest, X, and Snapchat can also know those things if the user is multi-homing across them. This non-rivalrous nature of data for ad targeting makes the industry different from others where ownership of an important input may mean that input is not available to competitors. As one professor at Harvard Business School notes, “demographic and user interest data can be acquired from a variety of sources, including data providers such as comScore and Nielsen [...] Other firms, from news publishers to smaller online stores, can also infer similar data on consumer characteristics to guide targeted advertising [...]”<sup>535</sup> One consequence of the non-rivalrous

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<sup>530</sup> “Yahoo DSP: Advertising Solutions,” *Yahoo! Advertising*, available at <https://www.advertising.yahooinc.com/our-dsp> (“huge scale, proprietary inventory, and unique data.”).

<sup>531</sup> “The Trade Desk Inc (TTD),” YCharts, July 19, 2024, available at [https://ycharts.com/companies/TTD/market\\_cap](https://ycharts.com/companies/TTD/market_cap).

<sup>532</sup> GOOG-DOJ-AT-01570215 at 220.

<sup>533</sup> Hal Varian, “Artificial Intelligence, Economics, and Industrial Organization,” Chapter 16 in *The Economics of Artificial Intelligence: An Agenda*, University of Chicago Press, 2019, pp. 399-422 at p. 405 (“But data is nonrival: one person’s use of data does not reduce or diminish another person’s use.”).

<sup>534</sup> Gans Report, ¶ 334.

<sup>535</sup> Marco Iansiti, “The Value of Data and Its Impact on Competition,” Harvard Business School NOM Unit Working Paper No. 22-002, July 20, 2021 (“Iansiti (2021)”), available at <http://dx.doi.org/10.2139/ssrn.3890387>.

nature of data is that new entrants can gain access to user information, reducing any data advantages of incumbent firms.

174. Advertisers and publishers collect a variety of data about their customers and website or app viewers through their normal course of business. Publishers often gather data through interactive content like surveys, quizzes, and multi-step forms, which engage users and provide insights into their preferences, demographics, personal details, and experiences. The types of data that can be collected and monetized include user behavior data, registration data, usage of website services, surveys and questionnaires, and intent data.<sup>536</sup> Such data can be used to identify customer needs, monitor product usage, and track consumer pain points.<sup>537</sup>

175. As Dr. Chandler suggests, display advertising firms can supplement their existing data by partnering with data brokers,<sup>538</sup> which can enhance their ability to target their advertising to a specific type of user. Examples of data brokers include Acxiom (acquired by IPG in 2018<sup>539</sup>) and Epsilon (acquired by Publicis in 2019<sup>540</sup>). Other example of data vendors specializing in different

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<sup>536</sup> Ivan Fedorov, “Data Monetization for Publishers: How to Collect and Sell Data [Ultimate Guide],” *Admixer*, May 27, 2020, available at <https://blog.admixer.com/data-monetization-for-publishers-how-to-collect-and-sell-data/>.

<sup>537</sup> Surbhi Sooni, “Customer analytics: Using data to improve the customer experience,” *LogRocket*, May 18, 2023, available at <https://blog.logrocket.com/product-management/customer-data-analytics-improve-experience/>; Lee Davis, “What Is Customer Analytics? (2024) Guide,” *Forbes Advisor*, May 2, 2024, available at <https://www.forbes.com/advisor/business/customer-analytics/>.

<sup>538</sup> Chandler Report, ¶ 285.

<sup>539</sup> “Acxiom Marketing Solutions Joins IPG Family of Companies,” *Acxiom*, October 1, 2018, available at <https://www.acxiom.com/news/acxiom-marketing-solutions-joins-ipg-family-of-companies/>; Vibhuti Sharma, “Interpublic to buy Acxiom’s marketing solutions division for \$2.3 billion,” *Reuters*, July 2, 2018, available at <https://www.reuters.com/article/us-acxiom-divestiture-interpublic-grp/interpublic-to-buy-acxioms-marketing-solutions-division-for-2-3-billion-idUSKBN1JS2IQ/>.

<sup>540</sup> “Publicis Groupe Finalizes the Acquisition of Epsilon,” *Epsilon*, July 2, 2019, available at <https://www.epsilon.com/us/about-us/pressroom/publicis-groupe-finalizes-the-acquisition-of-epsilon/>; Megan Graham, “Publicis announces \$4.4 billion deal to acquire data marketing company Epsilon,” *CNBC*, April 14, 2019, available at <https://www.cnn.com/2019/04/14/publicis-to-buy-epsilon-for-4point4-billion.html>.

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sectors include Datalogix,<sup>541</sup> DataSift,<sup>542</sup> IRI,<sup>543</sup> and several others.<sup>544</sup> Indeed, third-party data are widely available via data brokers. As a 2014 FTC report explained, “[d]ata brokers – companies that collect consumers’ personal information and resell or share that information with others – are important participants in this Big Data economy,” and “one data broker’s database has information on 1.4 billion consumer transactions and over 700 billion aggregated data elements; another data broker’s database covers one trillion dollars in consumer transactions; and yet another data broker adds three billion new records each month to its databases. Most importantly, data brokers hold a vast array of information on individual consumers. For example, one of the nine data brokers [studied by the FTC] has 3000 data segments for nearly every U.S. consumer.”<sup>545</sup>

176. Advertisers, publishers, and ad tech providers can also work with data management platforms (DMPs) to manage and analyze their own first-party data and to integrate it with third-party data to target specific types of users more effectively.<sup>546</sup> Advertisers, agencies, and publishers use data management platforms to improve ad targeting and conduct advanced

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<sup>541</sup> Datalogix, founded in 2002 and acquired by Oracle in 2014, offers ad tech products/services including digital marketing optimizations and targeting. *See* “Oracle Buys DataLogix Creates the World’s Most Valuable Data Cloud to Maximize the Power of Digital Marketing,” *Oracle*, December 22, 2014, available at <https://www.oracle.com/corporate/pressrelease/oracle-buys-datalogix-122214.html>; “Datalogix,” *Crunchbase*, available at <https://www.crunchbase.com/organization/datalogix>.

<sup>542</sup> DataSift, founded in 2010 and acquired by Meltwater in 2018, offers ad tech products/services including programmatic data analytics of social networks. *See* “DataSift,” *Crunchbase*, available at <https://www.crunchbase.com/organization/datasift>; “Meltwater acquires privacy-by-design social data platform DataSift to strengthen its AI-driven analytics offering,” *Meltwater*, March 19, 2018, available at <https://www.meltwater.com/en/about/press-releases/meltwater-acquires-datasift>.

<sup>543</sup> IRI, founded in 1979, offers ad tech products/services including market analytics, in-market execution, and big data technology. *See* “History in the Making,” *IRI*, available at <https://www.iriworldwide.com/en-nz/company/history>.

<sup>544</sup> Meta S. Brown, “16 Major Data Vendors,” *Dummies*, March 26, 2016, available at <https://www.dummies.com/article/technology/information-technology/data-science/general-data-science/16-major-data-vendors-148169/>.

<sup>545</sup> Federal Trade Commission, “Data Brokers: A Call for Transparency and Accountability,” *Federal Trade Commission*, May 2014, available at <https://www.ftc.gov/system/files/documents/reports/data-brokers-call-transparency-accountability-report-federal-trade-commission-may-2014/140527databrokerreport.pdf>, at pp. i, iv.

<sup>546</sup> *See, e.g.*, Maciej Zawadziński, and Mike Sweeney, “What is a Data Management Platform (DMP) and How Does it Work?” *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/data-management-platforms/>.

analytics.<sup>547</sup> Data management platforms allow advertisers to combine data from different sources (*e.g.*, customer email lists, offline customer relationship management (CRM) tools, mobile and web apps, ad campaign information, transactional data, offline point-of-sales systems) to generate a clear picture of their audience and customers.<sup>548</sup> For example, data management platforms can be used to improve media-buying decisions (*i.e.*, ad tech operations) or to deliver customized communications to existing customers.<sup>549</sup> Examples of data management platforms include Adobe Audience Manager (part of the Adobe Experience Cloud tech stack),<sup>550</sup> Audience Studio (a data management platform from Salesforce that allows businesses to unify their data from many sources, such as CRM, web analytics, social media, and third-party data providers),<sup>551</sup> and Lotame (a data management platform that collects data from various sources like websites, apps, over-the-top (or OTT) devices, and smart TVs).<sup>552</sup>

177. Many data management platforms cater to small- and medium-sized businesses, as well as to larger advertisers. Examples of data management platforms that provide services specifically to small businesses include V12 Data, Lotame Spherical Platform, PreciseFP,

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<sup>547</sup> See, *e.g.*, Maciej Zawadziński, and Mike Sweeney, “What is a Data Management Platform (DMP) and How Does it Work?” *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/data-management-platforms/>.

<sup>548</sup> “Data Management Platforms (DMPs) and Data Usage,” Chapter 11 in *The Ad Tech Book*, Clearcode, available at <https://adtechbook.clearcode.cc/dmp-and-data-usage/>.

<sup>549</sup> Michal Wlosik, “What is MadTech? The Convergence of AdTech and MarTech,” *Clearcode*, December 6, 2023, available at <https://clearcode.cc/blog/what-is-madtech/>.

<sup>550</sup> Adobe Audience Manager integrates with other third-party solutions as well. Users of this DMP include Princess Cruises, Hyatt and Condé Nast among others. See “Technology is moving forward. Your strategy should be too.” *Adobe Experience Cloud*, available at <https://business.adobe.com/products/audience-manager/adobe-audience-manager.html>; “Princess Cruises entertains new audiences with personalized messaging through Adobe Experience Cloud,” *Adobe Experience Cloud*, available at <https://business.adobe.com/customer-success-stories/princess-cruises-case-study-html.html>; “Hyatt selects Adobe Experience Manager for Digital Asset Management,” *Apps Run The World*, available at <https://www.appsruntheworld.com/customers-database/purchases/view/hyatt-hotels-corporation-united-states-selects-adobe-experience-manager-for-digital-asset-management>; “Condé Nast, fashioning quality brands.” *Condé Nast*, available at <https://business.adobe.com/content/dam/www/en/customer-success/pdfs/conde-nast-adobe-marketing-cloud-case-study.pdf>.

<sup>551</sup> MarTech, “The Best Data Management Platforms Of 2024,” *PROTEAN STUDIOS*, February 26, 2024, available at <https://proteanstudios.com/the-best-data-management-platforms-of-2024>.

<sup>552</sup> MarTech, “The Best Data Management Platforms Of 2024,” *PROTEAN STUDIOS*, February 26, 2024, available at <https://proteanstudios.com/the-best-data-management-platforms-of-2024>.

Permutive, Simpli.fi, and OnAudience.<sup>553</sup> A number of new data management platforms offer services that do not rely on cookies. For example, Adform and Permutive have created data management platforms that explicitly do not rely on third-party cookies.<sup>554</sup> Similarly, IplusX offers “cookieless” data solutions that it claims are “privacy-compliant.”<sup>555</sup>

178. In addition to data brokers and data management platforms, advertisers and agencies also have more opportunities to improve their targeting capabilities by combining the user data that they possess with user data from publishers and sell-side ad tech tools. For example, the agency Horizon Media formed a direct buying integration with ad exchange OpenX that combines Horizon’s user data (in the form of its identity graph Blu.ID) with OpenX’s data activation product OpenAudience, with the goal of “ensur[ing] higher match rates, so advertisers can activate more of their audience, increasing the scale and accuracy of every campaign.”<sup>556</sup> Similarly, the agency Havas formed a direct buying integration with Freewheel (an integrated ad exchange and ad server) to leverage “direct access to publisher supply [and] improve programmatic targeting.”<sup>557</sup>

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<sup>553</sup> “Best Data Management Platforms (DMP) for Small Businesses,” *G2*, available at <https://www.g2.com/categories/data-management-platform-dmp/small-business>.

<sup>554</sup> “Adform’s Proven First-Party ID Solution Is Ready To Solve the Cookie Problem,” *Adform*, August 24, 2020, available at <https://site.adform.com/resources/newsroom/adform-s-proven-first-party-id-solution-is-ready-to-solve-the-cookie-problem-1/> (“Adform is uniquely well-placed to drive the switch from third to first-party data, thanks to its integrated advertising platform (IAP). With its end-to-end stack built from the ground up — including a supply-side platform (SSP), demand-side platform (DSP), data-management platform (DMP) and ad server — Adform has a complete digital marketing infrastructure that has allowed it to rebuild the entire supply and demand path around first-party IDs.”); Alexandra Bannerman, “Permutive is evolving from a DMP to an Audience Platform,” *Permutive*, July 15, 2021, available at <https://permutive.com/blog/permutive-is-evolving-from-a-dmp-to-an-audience-platform/> (“Audience Platform allows publishers to collect, model and analyse large volumes of data that update in real-time. With no need for third-party cookies or IDs, publishers stay fully in control of their data.”).

<sup>555</sup> “IplusX Expands into the US, Offering Cookieless Targeting Capabilities to Brands and Publishers,” *IplusX*, September 7, 2023, available at <https://www.1plusx.com/press-corner/1plusx-us-expansion> (“IplusX’s advanced, next-generation predictive marketing intelligence platform has been developed to meet the growing need for cookieless data solutions across web, mobile, app, and CTV environments. Already used by several key customers in the US, the IplusX platform leverages AI-powered predictive technologies to deliver precise audience targeting and enable privacy-compliant data collaboration.”).

<sup>556</sup> “OpenX Announces First Programmatic Horizon Media Blu.ID Integration,” *OpenX*, January 30, 2023, available at <https://www.openx.com/press-releases/horizon-blu-id-integration/>.

<sup>557</sup> Alyssa Boyle, “Havas Media Names FreeWheel A Preferred SSP,” *AdExchanger*, February 1, 2023, available at <https://www.adexchanger.com/digital-tv/havas-media-names-freewheel-a-preferred-ssp/>.



179. Competitors are also building user-targeting services that rely on entirely new capabilities. For example, The Trade Desk has built an [REDACTED] [REDACTED] called Unified ID 2.0 (“UID2”) which is intended “to benefit the entire ecosystem.”<sup>558</sup> [REDACTED]

[REDACTED] 559  
UID2 is [REDACTED] “integrat[able] with other deterministic and personally identifiable information-based identifiers” and “enabl[es] cross-device and cross-channel identity strategies without cookies.”<sup>560</sup> [REDACTED]

[REDACTED] 561 Such innovations further undermine assertions that Google holds any unique advantages as a result of its access to data.

180. Dr. Chandler claims that “advertisers would benefit greatly from having access to user engagement data, viewability metrics, fraud detection information, ad placement context, and historical performance data. These insights would enable them to refine their bidding strategies, ensure their ads are seen by the right audience, and achieve better campaign outcomes in the competitive landscape of programmatic auctions.”<sup>562</sup> Dr. Chandler calls this the “Buy Side Wish List,”<sup>563</sup> implying that advertisers do not already have access to these five categories of

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<sup>558</sup> [REDACTED]; “Unified ID 2.0,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/about-us/industry-initiatives/unified-id-solution-2-0>; Brock Munro, “What is Unified ID 2.0?” *Publift*, July 15, 2024, available at <https://www.publift.com/blog/unified-id-2-0> (“Unified ID 2.0 (UID2) is a privacy-focused, unencrypted alphanumeric identifier created from a user’s email address or phone number. It is independent of third-party cookies and supports advertisers’ need for running personalized ads that are targeted to specific consumers without compromising their privacy [...] There are dozens of UID2 partners, including publishers, supply-side platforms (SSPs) as well as data providers. [...] What distinguishes this open-source ID framework from others is that users need to provide their consent to a publisher and share their email address before the latter can create a unique identifier. The ID will remain open but will be constantly hashed to protect a user’s privacy.”).

<sup>559</sup> [REDACTED].

<sup>560</sup> [REDACTED]; “Unified ID 2.0,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/about-us/industry-initiatives/unified-id-solution-2-0>.

<sup>561</sup> [REDACTED]; “The Trade Desk and Walmart Connect Will Test Integration of Unified ID 2.0 into the Walmart DSP,” *The Trade Desk*, June 20, 2023, available at <https://www.thetradedesk.com/us/news/press-room/the-trade-desk-and-walmart-connect-will-test-integration-of-unified-id-2-0-into-the-walmart>.

<sup>562</sup> Chandler Report, ¶ 325.

<sup>563</sup> Chandler Report, Section IX.G.1.

data/metrics. But that is not the case. In what follows below, I enumerate illustrative examples of companies with whom advertisers collaborate to access these data and metrics, and in some cases have done so for many years. These examples demonstrate that, contrary to Dr. Chandler's implication, advertisers already have access to this data from which they can "benefit greatly."<sup>564</sup>

- **Viewability metrics and fraud detection information:** Companies like Integral Ad Science (IAS) and DoubleVerify offer viewability<sup>565</sup> metrics and fraud detection data to advertisers and other ad tech industry players.<sup>566, 567</sup> Similarly, advertisers can partner with companies like Ad.Plus and diDNA to implement ad viewability tracking and optimization.<sup>568, 569</sup> In my own academic collaboration with C3 Metrics, since 2013, my co-authors and I have analyzed ad viewability data from advertisers who were working with C3 Metrics.<sup>570</sup> Google has also been tracking viewable impressions, which it began doing in 2012.<sup>571</sup>
- **User engagement data:** Adobe Analytics and Google Analytics have offered various forms of user behavior and engagement data to advertisers for years.<sup>572</sup> Adobe Analytics and Google Analytics serve different needs and resources of its customers, with Adobe

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<sup>564</sup> Chandler Report, ¶ 325.

<sup>565</sup> A viewable impression is a measure of whether a given advert was actually seen by a human being, as opposed to being out of view or served as the result of automated activity. Dr. Chandler defines the 'Viewability' metric in Chandler Report, Footnote 18.

<sup>566</sup> "Beyond Verification: Measuring Ad Exposure and Engagement for Publishers," *DV Publisher Suite*, July 29, 2021, available at <https://pub.doubleverify.com/blog/beyond-verification-measuring-ad-exposure-and-engagement-for-publishers/>.

<sup>567</sup> "If an Ad Is Out of View, It Can't Reach Its Full Potential," *IAS*, available at <https://integralads.com/solutions/viewability/>.

<sup>568</sup> Ad. Plus, "Boosting Ad Viewability: A Comprehensive Guide for Digital Publishers," *Ad.Plus*, May 13, 2024, available at <https://blog.ad.plus/ad-viewability/>.

<sup>569</sup> Deke Hooper, "The Ultimate Guide to Ad Viewability," *diDNA*, May 6, 2024, available at <https://didna.io/the-ultimate-guide-to-ad-viewability/>.

<sup>570</sup> Anindya Ghose, and Vilma Todri-Adamopoulos, "Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior," *MIS Quarterly*, Vol. 40, No. 4, 2016, pp. 889-910; Vilma Todri, Anindya Ghose, and Param Vir Singh, "Trade-Offs in Online Advertising: Advertising Effectiveness and Annoyance Dynamics Across the Purchase Funnel," *Information Systems Research*, Vol. 31, No. 1, 2020, pp. 102-125.

<sup>571</sup> Zach Rodgers, "Google to Support 'Viewable Impressions' and Online GRPs," *AdExchanger*, April 18, 2012, available at <https://www.adexchanger.com/online-advertising/google-to-support-viewable-impressions-grp/>.

<sup>572</sup> Andrei Kholkin, "Google Analytics vs Adobe Analytics: A Comparative Guide," *Weberlo*, January 13, 2024, available at <https://www.weberlo.com/reviews/google-analytics-vs-adobe-analytics>.



Analytics typically being better suited for enterprises requiring detailed customization, and Google Analytics typically offering a solution for businesses of all levels of sophistication. Advertisers also access user engagement data through Sprinklr, which provides tools for tracking user engagement, gathering feedback, and analyzing customer behavior across channels.<sup>573</sup> Verint’s Engagement Data Hub aggregates customer interaction data from multiple sources.<sup>574</sup> Amplitude and Mixpanel offer detailed insights into user engagement within digital products and apps.<sup>575</sup> Finally, Hotjar provides heatmaps, session recordings, and other engagement metrics for websites.<sup>576</sup>

- **Ad placement context and historical performance data:** Ad tech providers like AdRoll, AdEspresso, Facebook, and X (formerly Twitter) have ad platforms that provide ad placement and contextual metrics to their customers.<sup>577</sup> Various ad tech companies provide access to programmatic advertising inventory and offer detailed campaign performance data and historical insights. For example, DSPs empower advertisers with data analytics to track key performance indicators, analyze audience insights, and adjust campaigns in real time for optimal performance. They store performance data and generate aggregated reports accessible through the user interface.<sup>578</sup> Data management platforms like Oracle BlueKai and Lotame aggregate and analyze large datasets to

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<sup>573</sup> Issac Thomas, “11 Top Customer Engagement Platforms in 2024 [+User Reviews],” *Sprinklr*, April 10, 2024, available at <https://www.sprinklr.com/blog/customer-engagement-platforms/>.

<sup>574</sup> “Engagement Data,” *Verint*, available at <https://www.verint.com/engagement-data/>.

<sup>575</sup> Amplitude offers tools for “in-depth, real-time insights into product usage and user behavior[,]” including features like “event segmentation, funnel analysis, user cohorts, and retention analysis.” Mixpanel allows one “to track and analyze in-app product engagement[,]” providing visibility into various moments of the customer experience. See “Heap vs Amplitude vs Mixpanel for User Engagement Analysis,” *Userpilot Blog*, May 29, 2024, available at <https://userpilot.com/blog/heap-vs-amplitude-vs-mixpanel-for-user-engagement-analysis/>; The Statsig Team, “Amplitude vs Mixpanel: Which Analytics Tool is Right for You?” *Statsig*, July 5, 2024, available at <https://www.statsig.com/perspectives/amplitude-vs-mixpanel-which-analytics-tool-is-right-for-you>.

<sup>576</sup> “What is user engagement and how can you improve it?” *Hotjar*, September 21, 2022, available at <https://www.hotjar.com/user-engagement/>; “What is User Engagement Analysis? Top 9 Metrics to Track,” *Userpilot Blog*, March 7, 2024, available at <https://userpilot.com/blog/user-engagement-analysis/>.

<sup>577</sup> keenioblog, “Key Metrics For Successful AdTech Analytics,” *Keen*, December 13, 2019, available at <https://keen.io/blog/key-metrics-for-successful-adtech-analytics/>.

<sup>578</sup> Anete Jodzevica, “10 Best Demand Side Platforms (DSPs) For Programmatic Advertising in 2024,” *Setupad Blog*, May 30, 2024, available at <https://setupad.com/blog/best-demand-side-platforms/>.

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provide insights into audience behavior and targeting opportunities.<sup>579</sup> These platforms help advertisers refine their targeting strategies based on historical performance data. Lotame, for example, allows its users to access first-party data from sources like social media and mobile apps, and also provides the opportunity to expand on available data through its data marketplace.<sup>580</sup>

181. Thus, contrary to Dr. Chandler’s suggestion that advertisers lack access to this type of data, by leveraging data from these various sources, advertisers have been able to gain comprehensive insights into user engagement, ad performance, viewability, fraud detection, and campaign effectiveness across different channels and platforms for many years now.

182. Dr. Chandler also claims that “publishers would greatly benefit from access to all bids submitted during auctions, knowledge of losing bids, detailed advertiser data, and real-time market trends.”<sup>581</sup> This “Sell Side Wish List”<sup>582</sup> would purportedly “enable them to refine their pricing strategies, optimize their inventory management, and achieve better revenue outcomes in the competitive landscape of programmatic auctions.”<sup>583</sup> It is important to note that publishers may be restricted from accessing detailed advertiser data due to privacy concerns. Putting that aside, Dr. Chandler again seems to imply that publishers do not have access to these categories of data/metrics. But that is not the case. Below, I provide examples of companies with whom publishers can and do collaborate to access these data and metrics.

- **Bids submitted during auctions, knowledge of losing bids:** Companies like Google, Amazon, and Index Exchange, and independent header bidding solutions like Prebid, offer varying levels of transparency and data access.<sup>584</sup> Prebid, TAM, and Google each

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<sup>579</sup> MarTech, “The Best Data Management Platforms Of 2024,” *PROTEAN STUDIOS*, February 26, 2024, available at <https://proteanstudios.com/the-best-data-management-platforms-of-2024>; “Compare Lotame Spherical Platform and Oracle BlueKai Data Management Platform,” *G2*, available at <https://www.g2.com/compare/lotame-spherical-platform-vs-oracle-bluekai-data-management-platform>.

<sup>580</sup> Daniel Mironov, “12 Top Programmatic Advertising Platforms in 2024,” *Improvado*, July 23, 2024, available at <https://improvado.io/blog/top-programmatic-platforms>.

<sup>581</sup> Chandler Report, ¶ 331.

<sup>582</sup> Chandler Report, Section IX.G.2.

<sup>583</sup> Chandler Report, ¶ 331.

<sup>584</sup> Sarah Sluis, “3 Auctions Rule Digital Advertising. Here’s A Guide To Navigating Them,” *AdExchanger*, November 20, 2019, available at <https://www.adexchanger.com/platforms/3-auctions-rule-digital-advertising->

give publishers and buyers access to different historical data about ad performance.<sup>585</sup> In Prebid, publishers get consistent access to log-level data.<sup>586</sup> TAM offers samples of auction logs to publishers so they can verify that Amazon is running a first-price auction—but not full logs, which could lead to data mining. Google offers Data Transfer report files to publishers, which “provide non-aggregated, event-level data” from Google Ad Manager auctions.<sup>587</sup> An Amazon source confirms that “SSPs provide detailed reports about the performance of the ad inventory, giving publishers the opportunity to optimize their campaigns.”<sup>588</sup> Another source describes the ability to work with bid stream data which is data connected to a publisher’s bid request.<sup>589</sup> This includes data on the website or app, the ad format, as well as the visitor’s device type and IP address.<sup>590</sup>

- **Advertiser data and market trends:** Publishers often work with multiple partners and technologies to gain a more comprehensive view of their auction performance and market trends. By combining data from multiple SSPs, auction solutions, and analytics tools, publishers can piece together a more complete picture of auction dynamics and advertiser behavior.

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heres-a-guide-to-navigating-them/; “Log-Level Data 101 for Publishers,” *DV Publisher Suite*, January 12, 2020, available at <https://pub.doubleverify.com/blog/log-level-data-101-for-publishers/> (“For example, Index Exchange offers Client Audit Logs that provide impression level data including dimensions such as Advertiser, Buyer, and DSP. These fields are not available in Index’s standard UI or API so using the Client Audit Log feed provides obvious incremental value in that it allows publishers to perform buy side analysis to identify the demand path for their revenue [...].”).

<sup>585</sup> Sarah Sluis, “3 Auctions Rule Digital Advertising. Here’s A Guide To Navigating Them,” *AdExchanger*, November 20, 2019, available at <https://www.adexchanger.com/platforms/3-auctions-rule-digital-advertising-heres-a-guide-to-navigating-them/>.

<sup>586</sup> Sarah Sluis, “3 Auctions Rule Digital Advertising. Here’s A Guide To Navigating Them,” *AdExchanger*, November 20, 2019, available at <https://www.adexchanger.com/platforms/3-auctions-rule-digital-advertising-heres-a-guide-to-navigating-them/> (“Prebid offers the most granular information. Publishers get consistent access to log-level data.”).

<sup>587</sup> “Ad Manager Data Transfer reports,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/1733124?hl=en>.

<sup>588</sup> “What is a Supply-Side Platform (SSP)? Here’s everything you need to know,” *Amazon Ads*, available at <https://advertising.amazon.com/library/guides/supply-side-platform>.

<sup>589</sup> Brock Munro, “What is Bidstream Data?” *Publift*, June 27, 2024, available at <https://www.publift.com/blog/bidstream-data>.

<sup>590</sup> Brock Munro, “What is Bidstream Data?” *Publift*, June 27, 2024, available at <https://www.publift.com/blog/bidstream-data>.

183. Hence, this is no reliable basis for Dr. Chandler to claim that advertisers and publishers do not have access to the data on their “wish lists.”

**B. High transaction volumes and large scale of data are not substantial barriers to entry.**

184. Plaintiffs’ experts wrongly claim that scaled user data plays a critical role in web display advertising. Professor Gans claims that “[t]he scale of data required for effective operation in the market for publisher ad servers used for the sale of open web display advertising acts as a significant deterrent to new entrants[,]”<sup>591</sup> that “DFP’s data advantage allows it to implement algorithms that competitors cannot offer due to insufficient scale,”<sup>592</sup> and that scaled data acts as a barrier to entry for ad buying tools for small advertisers.<sup>593</sup> Dr. Chandler states that “Google’s scale advantage in the digital advertising ecosystem is formidable.”<sup>594</sup> But Plaintiffs’ experts overemphasize the power of Google’s data.<sup>595</sup>

185. Plaintiffs’ experts ignore academic research demonstrating that data have diminishing returns to scale—in other words, incremental additions of data are increasingly less valuable—which suggests that companies with large amounts of user data are not necessarily more competitive than companies with relatively less user data. For example, one study used large-scale randomized experiments conducted by Yahoo Research to assess how the quantity of user data impacted the ability to predict sales through digital advertising. The study found that “exceptional consumer-level data including demographics, ad exposure levels, and two years’ worth of past purchase history” only marginally improved ad measurement precision by a

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<sup>591</sup> Gans Report, ¶ 364.

<sup>592</sup> Gans Report, ¶ 366.

<sup>593</sup> Gans Report, ¶¶ 404-405.

<sup>594</sup> Chandler Report, ¶ 284.

<sup>595</sup> Professor Gans references in passing Google’s “large volume of [...] transaction data” as a barrier to entry, (*see* Gans Report, ¶ 363), but he provides no evidence to support that statement. Nonetheless, Google’s access to transaction data would not pose a barrier to entry, because individual user-level data (which, as described below, are widely available) can be systematically linked through a series of simultaneous equations in econometrics to predict bidding behavior and auction outcomes. Academic research has discussed the relationship between targeting criteria and bids in online auctions. *See, e.g.*, Eric Zeng, Rachel McAmis, Tadayoshi Kohno, and Franziska Roesner, “What Factors Affect Targeting and Bids in Online Advertising? A Field Measurement Study,” *Proceedings of the 22nd ACM Internet Measurement Conference*, 2022, pp. 210-229.

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“disappoint[ing]” amount (5%), whereas “[l]ess data gives us 31% more precision in our estimates.”<sup>596</sup> Research on the value of Amazon data showed diminishing returns to data size with respect to demand prediction accuracy over time for a single product and small gains to demand prediction accuracy across products as data size increased.<sup>597</sup> A recent study on the efficacy of human versus data-driven (“algorithmic”) recommendations on a news website found “that the value of individual-level information for the algorithm increases at a diminishing rate.”<sup>598</sup> Moreover, the marginal returns from data diminish quickly for prediction accuracy and targeting effectiveness.<sup>599</sup> A professor at Harvard Business School observed that, “[i]n some cases, joining together diverse datasets, including granular consumer-level information, may not improve the performance of targeted advertisements as the data may not be complementary.”<sup>600</sup>

186. Research also suggests that whatever benefits may accrue from access to additional data, those benefits do not create substantial barriers to entry. In a paper reviewing case studies of Netflix, Waymo, and online advertising,<sup>601</sup> the author notes that “[w]hile both Netflix and Waymo have made significant investments in developing the capabilities and infrastructure required to leverage data at petabyte-scale, neither has been able to avoid competition. In fact,

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<sup>596</sup> Garrett A. Johnson, Randall A. Lewis, and David H. Reiley, “When Less Is More: Data and Power in Advertising Experiments,” *Marketing Science*, Vol. 36, No. 1, 2017, pp. 43-53 at p. 43.

<sup>597</sup> Patrick Bajari, Victor Chernozhukov, Ali Hortaçsu, and Junichi Suzuki, “The Impact of Big Data on Firm Performance: An Empirical Investigation,” *National Bureau of Economic Research*, Working Paper No. 24334, February 2018, available at <https://www.nber.org/papers/w24334>.

<sup>598</sup> Christian Peukert, Ananya Sen, and Jörg Claussen, “The Editor and the Algorithm Recommendation Technology in Online News,” forthcoming in *Management Science*, 2023, pp. 1-16 at p. 2.

<sup>599</sup> For instance, in a machine-learning experiment to categorize dog breeds using images of dogs, researchers found that as the number of training images increases, the mean accuracy of categorization increases at a decreasing rate. See Aditya Khosla, Nityananda Jayadevaprakash, Bangpeng Yao, and Li Fei-Fei, “Stanford Dogs Dataset,” *Stanford University*, available at <http://vision.stanford.edu/aditya86/ImageNetDogs/>; Hal Varian, “Artificial Intelligence, Economics, and Industrial Organization,” Chapter 16 in *The Economics of Artificial Intelligence: An Agenda*, University of Chicago Press, 2019, pp. 399-422 at p. 406 (“[D]ata typically exhibits decreasing returns to scale like any other factor of production. [...] Other factors such as improved algorithms, improved hardware, and improved expertise have been much more important than the number of observations in the training data.”). Other studies have shown that the computational requirements to improve performance in machine-learning increase exponentially as the error rate decreases. See Neil C. Thompson, Kristjan Greenewald, Keeheon Lee, and Gabriel F. Manso, “Deep Learning’s Diminishing Returns,” *IEEE Spectrum*, September 24, 2021, available at <https://spectrum.ieee.org/deep-learning-computational-cost>; Neil C. Thompson, Kristjan Greenewald, Keeheon Lee, and Gabriel F. Manso, “The Computational Limits of Deep Learning,” *Arxiv*, July 27, 2022, available at <https://arxiv.org/abs/2007.05558>.

<sup>600</sup> Iansiti (2021) at p. 16.

<sup>601</sup> Iansiti (2021).

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both firms have seen increasing levels of competition and innovation in their respective markets.”<sup>602</sup> Despite its data scale advantage, Netflix continued to compete with later entrants to the streaming video such as Disney, HBO, and Apple. In the case of online advertising, the author found that “there is nuance required in assessing data value and data is often not the sole determinant of success.”<sup>603</sup> Further, regarding the value of scale in advertising data, the author finds, “[t]his value can be significantly less than is often assumed in regulatory discussions,” and it “depends on many factors including data quality, complementarity with other existing data, how data drive improvements in personalization, and, in turn, when increased personalization translates into increased ad effectiveness.”<sup>604</sup> The author’s key takeaway was that “it is difficult to conclude that the success of platforms in online advertising is solely due to the scale and scope of data accumulated. Their success is more likely due to a confluence of factors, including not only the value of data collected, but also innovation in product development, a competitive pricing strategy, and extensive sales efforts.”<sup>605</sup> This conclusion calls into question Plaintiffs’ experts’ claims that “[t]he scale of data [...] acts as a significant deterrent to new entrants.”<sup>606</sup>

187. Professor Gans notes that “a platform having exclusive access to user data that allows it to predict match quality and user purchase intent more precisely allows it to earn a premium for ads placed in an advertising market[.]”<sup>607</sup> but he provides no basis for claiming that Google has “exclusive access” to unique user data. As I explained above, user multi-homing allows many companies—including social media companies, connected TV firms, news media providers, and retailers—to develop information about users that can be used to “predict match quality and user purchase intent.”<sup>608</sup> And his position is further undercut by Dr. Chandler’s recognition that tech firms can “develop advanced algorithms and machine learning techniques for probabilistic

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<sup>602</sup> Iansiti (2021) at p. 3.

<sup>603</sup> Iansiti (2021) at p. 3.

<sup>604</sup> Iansiti (2021) at p. 15.

<sup>605</sup> Iansiti (2021) at p. 16.

<sup>606</sup> Gans Report, ¶ 364; Chandler Report, ¶¶ 284-285.

<sup>607</sup> Gans Report, ¶ 344.

<sup>608</sup> See **Section VI.A.**

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matching, which can improve match rates and targeting accuracy even without extensive first-party data.”<sup>609</sup>

188. Moreover, both Dr. Chandler and Professor Gans overemphasize the importance of data in improving the predictive power of machine learning algorithms because they ignore the impact that time dependency of data has on prediction accuracy. For example, researchers have noted that “when data lose relevance over time, it may be optimal to collect a limited amount of recent data instead of keeping around an infinite supply of older (less relevant) data.”<sup>610</sup> Time dependency of data is an important feature of the digital advertising ecosystem given the speed with which relevant advertisements must be matched to users and the changing dynamics of user behavior and ad tech. Further, large datasets are not always required to increase the accuracy of machine learning models. The same researchers have found that “a competing firm equipped with a limited (yet sufficient) amount of recent data can develop more accurate models[,] [...] suggest[ing] that created business value doesn’t scale with the stock of available data unless the firm offloads less relevant data from its data repository.”<sup>611</sup> These findings are consistent with my discussion above that returns from data diminish with scale of data.

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<sup>609</sup> Chandler Report, ¶ 285.

<sup>610</sup> Ehsan Valavi, Joel Hestness, Newsha Ardalani, and Marco Iansiti, “Time and the Value of Data,” Harvard Business School Working Paper, No. 21-016, 2020, available at [https://www.hbs.edu/ris/Publication%20Files/21-016\\_d5cc4876-c029-4540-8092-16a23778d86f.pdf](https://www.hbs.edu/ris/Publication%20Files/21-016_d5cc4876-c029-4540-8092-16a23778d86f.pdf), at p. 1 (“Managers often believe that collecting more data will continually improve the accuracy of their machine learning models. However, we argue in this paper that when data lose relevance over time, it may be optimal to collect a limited amount of recent data instead of keeping around an infinite supply of older (less relevant) data.”).

<sup>611</sup> Ehsan Valavi, Joel Hestness, Newsha Ardalani, and Marco Iansiti, “Time and the Value of Data,” Harvard Business School Working Paper, No. 21-016, 2020, available at [https://www.hbs.edu/ris/Publication%20Files/21-016\\_d5cc4876-c029-4540-8092-16a23778d86f.pdf](https://www.hbs.edu/ris/Publication%20Files/21-016_d5cc4876-c029-4540-8092-16a23778d86f.pdf), at p. 1 (“We argue that data’s time-dependency weakens the barrier to entry that the stock of data creates. As a result, a competing firm equipped with a limited (yet sufficient) amount of recent data can develop more accurate models. This result, coupled with the fact that older datasets may deteriorate models’ accuracy, suggests that created business value doesn’t scale with the stock of available data unless the firm offloads less relevant data from its data repository.”).



**C. Google and other firms are developing solutions to preserve consumer benefits from targeted advertising while protecting user privacy.**

189. Data privacy and security have become a focus for regulators in recent years, with governments passing privacy laws in Europe and a number of U.S. states.<sup>612</sup> Dr. Chandler acknowledges the impact of industry changes regarding data protection and user privacy on targeted advertising, stating, for example, “[t]he growing emphasis on privacy and data protection also poses challenges to cookie matching.”<sup>613</sup> (Cookie matching, also known as cookie syncing, is the process that allows ad tech players to synchronize their cookies or map “user IDs from one system to another.”<sup>614</sup>) Similarly, Dr. Chandler and Professor Gans also recognize that industry regulations “impose strict requirements on how user data can be collected, stored, and used,” creating additional challenges to targeted advertising.<sup>615</sup> However, Dr. Chandler claims that Google’s efforts to protect user privacy while also preserving consumer benefits from targeted advertising “undercut” other ad tech players,<sup>616</sup> and Professor Gans claims that Google’s

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<sup>612</sup> See, e.g., “Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation),” *EUR-Lex*, April 27, 2016, available at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02016R0679-20160504>; “AB-375 Privacy: personal information: businesses,” *California Legislative Information*, June 29, 2018, available at [https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\\_id=201720180AB375](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB375); “TITLE 1.81.5. California Consumer Privacy Act of 2018 [1798.100 - 1798.199.100],” *California Legislative Information*, November 3, 2020, available at [https://leginfo.ca.gov/faces/codes\\_displayText.xhtml?lawCode=CIV&division=3.&title=1.81.5.&part=4](https://leginfo.ca.gov/faces/codes_displayText.xhtml?lawCode=CIV&division=3.&title=1.81.5.&part=4); “Colorado Revised Statutes 2023: Title 6 Consumer and Commercial Affairs,” *Colorado General Assembly*, 2023, available at <https://leg.colorado.gov/sites/default/files/images/olls/crs2023-title-06.pdf>, at pp. 131-146 (Article 1, Part 13: Colorado Privacy Act); “Chapter 743jj Consumer Data Privacy And Online Monitoring,” *Connecticut General Assembly*, July 1, 2023, available at [https://www.cga.ct.gov/current/pub/chap\\_743jj.htm](https://www.cga.ct.gov/current/pub/chap_743jj.htm); “Chapter 61 Utah Consumer Privacy Act,” *Utah State Legislature*, December 31, 2023, available at [https://le.utah.gov/xcode/Title13/Chapter61/C13-61\\_2022050420231231.pdf](https://le.utah.gov/xcode/Title13/Chapter61/C13-61_2022050420231231.pdf); “Chapter 53. Consumer Data Protection Act,” *Virginia’s Legislative Information System*, May 17, 2024, available at <https://law.lis.virginia.gov/vacode/title59.1/chapter53/>.

<sup>613</sup> Chandler Report, ¶ 281.

<sup>614</sup> Brock Munro, “What is Cookie Syncing? How Does it Work?” *Publift*, June 28, 2024, available at <https://www.publift.com/blog/what-is-cookie-syncing>.

<sup>615</sup> Chandler Report, ¶ 281; Gans Report, ¶ 292 (“Finally, publishers and advertisers using ad servers, exchanges, or ad buying tools are subject to distinct regulatory limitations across geographies. In particular, regulations around user privacy and advertising deceptive trade practices vary from country to country.”).

<sup>616</sup> Chandler Report, ¶ 285 (“As I discuss below and in in [*sic*] Section X, Google’s ‘Privacy Sandbox’ program will undercut these efforts.”).



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efforts on data privacy are “pretextual.”<sup>617</sup> As I discuss below, Plaintiffs’ experts fail to acknowledge that Google is only one of the many ad tech providers that have focused recently on enhancing privacy protections for users.

190. The mid-1990s to late 2000s marked a significant period in the evolution of digital advertising, characterized by substantial advancements in user targeting and ad tracking technologies. These developments played a critical role in facilitating the measurement of ad effectiveness, thereby leading to more efficient and effective advertising strategies for businesses, and less annoying and more relevant ads for consumers. Prior to this, digital advertising had been something of a shot in the dark, with advertisers relying on broad demographic data and often only being able to guess the actual impact of their campaigns.<sup>618</sup>

191. One of the most notable advances during this period was the rise of behavioral targeting.<sup>619</sup> Advertisers began to compile detailed user profiles based on data on users’ online activities (*e.g.*, previous interactions with websites and ads). These profiles enabled advertisers to tailor their ads to the interests of individual users,<sup>620</sup> leading to more personalized and relevant advertising experiences. Behavioral targeting increased the effectiveness of ads, as the ads were more likely to resonate with users and lead to conversions. Cookies and pixel targeting were particularly helpful in this regard.

192. Cookies are small packets of code that website publishers and others transfer to users’ web browsers when users visit websites.<sup>621</sup> These small pieces of code allow advertisers to track

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<sup>617</sup> Gans Report, Section VII.D.2 (“Google’s claim that it redacted data based on privacy concerns is pretextual.”).

<sup>618</sup> This process often involved making educated guesses about which websites were frequented by their target demographics. For example, an advertiser aiming at young adults might place ads on websites that were popular with this age group, such as music or gaming sites. The assumption was that certain types of content would attract specific demographics, so by placing ads on pages with relevant content, advertisers hoped to reach their intended audience. However, this method was much less precise compared to the personalized targeting that became possible later, as it did not account for the diverse interests and behaviors of individual users within those demographics.

<sup>619</sup> Karla Hesterberg, “A Brief History of Online Advertising,” *HubSpot*, November 29, 2021, available at <https://blog.hubspot.com/marketing/history-of-online-advertising>.

<sup>620</sup> Barry Schwartz, “Google Gets Into Behavioral Targeting, Launches ‘Interest-Based Advertising’ Beta,” *Search Engine Land*, March 11, 2009, available at <https://searchengineland.com/google-introduces-interest-based-advertising-beta-16855>.

<sup>621</sup> “Cookies on Mobile 101,” *IAB*, November 2013, available at <https://www.iab.com/wp-content/uploads/2015/07/CookiesOnMobile101Final.pdf>; “Mobile Identity Guide for Marketers,” *IAB*, available at <https://www.iab.com/wp-content/uploads/2017/06/Mobile-Identity-Guide-for-Marketers-Report.pdf>.

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users' browsing activity across different websites, build detailed profiles of individual users, and offer insights into their online behavior beyond a single site or session. For example, if a user goes to a website that displays an ad, that ad might save a cookie on the user's computer.<sup>622</sup> A cookie may contain information about the user (such as pseudo-anonymous usernames, passwords, user preferences and settings, and products added to the user's cart) and/or certain actions taken by the user (such as ads viewed when the websites load and activity on websites). Cookies allow websites and advertisers to observe users' online behavior.<sup>623</sup> Cookies created by servers of the visited websites are known as "first-party" cookies, whereas cookies created by third-party servers (*i.e.*, a firm other than the website publisher, such as a publisher's ad tech provider) are known as "third-party" cookies.<sup>624</sup> The primary difference between first- and third-party cookies is that "[t]hird-party cookies track users across different websites, while first-party cookies are specific to the website being visited."<sup>625</sup>

193. It is important to note that the digital marketing industry as a whole, and not Google in particular, has been involved in the development of cookies and targeted advertising. The cookie was invented in 1992 by Netscape, and the introduction of third-party cookies in 1994 was a significant development for digital advertising.<sup>626</sup>

194. Third-party cookies have been used in display advertising for about two decades, primarily to track browsing history and activities for targeted advertising. That has begun to change in recent years, due to increased popular and regulatory focus on user privacy.<sup>627</sup>

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<sup>622</sup> Justin Mosgrober, "What Are Advertising Cookies and How Are They Used," *Gourmet Ads*, available at <https://www.gourmetads.com/articles/what-are-advertising-cookies-and-how-are-they-used/>.

<sup>623</sup> Dirk Bergemann, and Alessandro Bonatti, "Selling Cookies," *American Economic Journal: Microeconomics*, Vol. 7, No. 3, 2015, pp. 259-294.

<sup>624</sup> Brock Munro, "First Party Cookies vs. Third Party Cookies: What Is the Difference?" *Publift*, July 2, 2024, available at <https://www.publift.com/blog/first-party-vs-third-party-cookies>.

<sup>625</sup> "What Are Third-Party Cookies? (What You Need to Know)," *Captain Compliance*, May 13, 2024, available at <https://www.captaincompliance.com/education/third-party-cookies/> ("How do third-party cookies differ from first-party cookies? Third-party cookies track users across different websites, while first-party cookies are specific to the website being visited.").

<sup>626</sup> Vlad Gozman, "The Slow Death Of Third-Party Cookies," *Forbes*, September 12, 2022, available at <https://www.forbes.com/sites/theyec/2022/09/12/the-slow-death-of-third-party-cookies/?sh=6e8cbb540266>.

<sup>627</sup> Mike Sweeney, and Paulina Zawislak, "The Demise of Third-Party Cookies in AdTech: Why Are They Being Phased Out?" *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/third-party-cookies-demise/>; Allison Schiff, "Safari Enables Full-On Third-Party Cookie Blocking By Default (Aka, No More Workarounds

195. Given this increased emphasis on privacy, Google is hardly the first company to develop a plan to limit the tracking of consumers across the web. In June 2017, Apple announced an “Intelligent Tracking Prevention” (ITP) feature for its Safari browser, which was designed to limit third-party cookies from capturing cross-site browsing data.<sup>628</sup> Mozilla’s Firefox browser began blocking all third-party cookies by default starting in September 2019.<sup>629</sup> Apple’s Safari browser began to block all third-party cookies by default starting in March 2020.<sup>630</sup>

196. Apple’s App Tracking Transparency (ATT) feature, introduced in 2021 with iOS 14.5, marked a significant shift in how mobile apps on Apple devices could access and use individual user data for advertising purposes. This change has had important implications for the digital advertising industry, including companies like Google and Meta. ATT requires apps to explicitly ask users for permission to track their activity across other apps and websites. Before this, tracking through the “identifier for advertisers” (IDFA) was enabled by default for many apps and users had to opt out if they did not want to be tracked.<sup>631</sup> The update disrupted the continuous flow of data that app developers and advertisers previously tapped into to monitor user-specific activity across various apps and mobile websites.<sup>632</sup>

197. In September 2017, Google announced a new Google Analytics cookie that could be used to capture data on campaigns and conversions from Safari users while conforming to Apple’s

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Ever),” *AdExchanger*, March 24, 2020, available at <https://www.adexchanger.com/online-advertising/safari-enables-full-on-third-party-cookie-blocking-by-default-aka-no-more-workarounds-ever/>.

<sup>628</sup> Ginny Marvin, “WWDC: Safari will block third-party ad trackers from following users around the web,” *MarTech*, June 5, 2017, available at <https://martech.org/wwdc-safari-will-block-third-party-trackers-following-users-around-web/>.

<sup>629</sup> Marissa Wood, “Today’s Firefox Blocks Third-Party Tracking Cookies and Cryptomining by Default,” *dist://ed*, September 3, 2019, available at <https://blog.mozilla.org/en/products/firefox/todays-firefox-blocks-third-party-tracking-cookies-and-cryptomining-by-default/>.

<sup>630</sup> See, e.g., Nick Statt, “Apple updates Safari’s anti-tracking tech with full third-party cookie blocking,” *The Verge*, March 24, 2020, available at <https://www.theverge.com/2020/3/24/21192830/apple-safari-intelligent-tracking-privacy-full-third-party-cookie-blocking>.

<sup>631</sup> Users now must give clear consent when apps prompt users with a message: “Allow [app name] to track your activity across other companies’ apps and websites?” See Kate O’Flaherty, “Allow App To Track On Your iPhone—Here’s What It Means,” *Forbes*, November 13, 2021, available at <https://www.forbes.com/sites/kateoflahertyuk/2021/11/13/allow-app-to-track-on-your-iphone-heres-what-it-means/?sh=4885c2f62cc0>; Mstislav Grivachev, “IDFA changes are here. What do we know, and are we ready?” *Adapty*, January 16, 2024, available at <https://adapty.io/blog/idfa-changes-are-here/>.

<sup>632</sup> Julian Runge, and Eric Seufert, “Apple Is Changing How Digital Ads Work. Are Advertisers Prepared?” *Harvard Business Review*, April 26, 2021, available at <https://hbr.org/2021/04/apple-is-changing-how-digital-ads-work-are-advertisers-prepared>.

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ITP recommendations, *i.e.*, without the use of third-party cookies.<sup>633</sup> Meta, for its part, has published a report outlining how advertisers can best use their own first-party data plugged into Meta’s systems to create more personalized and effective campaigns.<sup>634</sup>

198. In August 2019, Google announced its intent to “develop new standards that advance privacy, while continuing to support free access to content.”<sup>635</sup> In this announcement, Google discussed a “Privacy Sandbox,” which was a “secure environment for personalization that also protects user privacy.”<sup>636</sup> Privacy Sandbox was an initiative to improve users’ privacy across the Web and apps on Android by phasing out third-party cookies and other forms of cross-site tracking<sup>637</sup> and instead using newer, privacy-enhancing techniques to deliver relevant ads.<sup>638</sup>

199. Since then, Google has proposed various iterations of the Privacy Sandbox<sup>639</sup> with oversight from the UK Competition & Markets Authority (the CMA).<sup>640</sup> Given that regulatory

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<sup>633</sup> Ginny Marvin, “Google responds to Apple’s Intelligent Tracking Prevention with AdWords tracking update,” *Search Engine Land*, September 8, 2017, available at <https://searchengineland.com/google-analytics-adwords-response-apple-intelligent-tracking-prevention-282233>.

<sup>634</sup> Andrew Hutchinson, “Meta Shares New Report on How to Make Best Use of First Party Data Insights,” *Social Media Today*, July 20, 2023, available at <https://www.socialmediatoday.com/news/meta-shares-new-report-how-make-best-use-first-party-data-insights/688585/>.

<sup>635</sup> Justin Schuh, “Building a more private web,” *Google The Keyword*, August 22, 2019, available at <https://www.blog.google/products/chrome/building-a-more-private-web/>.

<sup>636</sup> Justin Schuh, “Building a more private web,” *Google The Keyword*, August 22, 2019, available at <https://www.blog.google/products/chrome/building-a-more-private-web/>.

<sup>637</sup> Anthony Chavez, “Expanding testing for the Privacy Sandbox for the Web,” *Google The Keyword*, July 27, 2022, available at <https://blog.google/products/chrome/update-testing-privacy-sandbox-web/>; Competition and Markets Authority announced that Google is not deprecating third-party cookies. *See* Competition and Markets Authority, “Investigation into Google’s ‘Privacy Sandbox’ browser changes,” *GOV.UK*, July 22, 2024, available at <https://www.gov.uk/cma-cases/investigation-into-googles-privacy-sandbox-browser-changes>.

<sup>638</sup> “Privacy Sandbox for the Web,” *The Privacy Sandbox*, July 2024, available at <https://privacysandbox.com/open-web/>.

<sup>639</sup> For example, early in the development of Privacy Sandbox, Google announced a plan to replace third-party cookies in Chrome with a privacy-first alternative called FLoC or “Federated Learning of Cohorts.” FLoC was designed to cluster large groups of consumers with similar interests to be targeted by advertisements in place of individual targeting vis-a-vis third-party cookies. *See* Chetna Bindra, “Building a privacy-first future for web advertising,” *Google Ads & Commerce Blog*, January 25, 2021, available at <https://blog.google/products/ads-commerce/2021-01-privacy-sandbox/>. Google later proposed to replace FLoC, with Topics API, which would assign three broad “topics” (*e.g.*, “Fitness” or “Travel & Transportation”) to a user based on their past three weeks of browsing history to help sites (*i.e.*, publishers) serve targeted advertisements without use of third-party cookies. *See* Vinay Goel, “Get to know the new Topics API for Privacy Sandbox,” *Google The Keyword*, January 25, 2022, available at <https://blog.google/products/chrome/get-know-new-topics-api-privacy-sandbox/>.

<sup>640</sup> Competition and Markets Authority, “CMA to have key oversight role over Google’s planned removal of third-party cookies,” *GOV.UK*, June 11, 2021, available at <https://www.gov.uk/government/news/cma-to-have-key->

oversight, it is hard to imagine that Google’s Privacy Sandbox could have “undercut” Google’s rivals as Dr. Chandler fears.<sup>641</sup> Nonetheless, those fears are now moot, as Google recently announced that it would not be deprecating third-party cookies, and instead would “continue to make the Privacy Sandbox APIs available” while “elevat[ing] user choice” about their privacy settings and continuing to work with regulators like the CMA and the UK Information Commissioner’s Office.<sup>642</sup>

200. Google is not the only ad tech provider to take initiatives to enhance user privacy while preserving the ability to serve targeted advertisements to users. As a demand-side platform (DSP), The Trade Desk primarily uses third-party data (data collected from users while they are on websites and apps not owned by The Trade Desk) to inform its advertising. As the industry moves away from third-party cookies, The Trade Desk has proposed a new approach called Unified ID 2.0, which aims to preserve personalized advertising while improving user privacy and control.<sup>643</sup> Unified ID 2.0 relies on hashed or encrypted email addresses, which provide a level of anonymity, and it includes explicit user consent.

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oversight-role-over-google-s-planned-removal-of-third-party-cookies; “CMA Q1 2024 update report on implementation of the Privacy Sandbox commitment,” *Competition & Markets Authority*, April 2024, available at [https://assets.publishing.service.gov.uk/media/662baa3efee48e2ee6b81eb1/1\\_CMA\\_Q1\\_2024\\_update\\_report\\_on\\_Google\\_Privacy\\_Sandbox\\_commitments.pdf](https://assets.publishing.service.gov.uk/media/662baa3efee48e2ee6b81eb1/1_CMA_Q1_2024_update_report_on_Google_Privacy_Sandbox_commitments.pdf), at p. 3 (“Given the time needed to resolve outstanding issues and take account of testing results, we have agreed with Google that there should be a limited delay to third-party cookie deprecation.”).

<sup>641</sup> Chandler Report, ¶¶ 285, 291-293.

<sup>642</sup> Anthony Chavez, “A new path for Privacy Sandbox on the web,” *The Privacy Sandbox*, July 22, 2024, available at <https://privacysandbox.com/news/privacy-sandbox-update/>; see also Competition and Markets Authority, “Investigation into Google’s ‘Privacy Sandbox’ browser changes,” *GOV.UK*, July 22, 2024, available at <https://www.gov.uk/cma-cases/investigation-into-googles-privacy-sandbox-browser-changes> (“The CMA will now work closely with the ICO to carefully consider Google’s new approach to Privacy Sandbox.”).

<sup>643</sup> See, e.g., “Unified ID 2.0,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/about-us/industry-initiatives/unified-id-solution-2-0>; “Unified ID 2.0 Overview,” *Unified ID 2.0*, available at <https://unifiedid.com/docs/intro>.

**VII. PLAINTIFFS PAINT A SELECTIVE AND OUTDATED PICTURE OF HOW DISPLAY ADVERTISING SALES HAVE EVOLVED TO MISCONSTRUE GOOGLE’S CONDUCT.**

201. Not only do Plaintiffs’ experts’ theories focus on a narrow slice of online display advertising (as described in **Section III**), but they also omit and mischaracterize the development of display advertising technology to paint a flawed picture of Google’s conduct.

202. This history, and Google’s role in it, was critical to developing the free and open internet that exists today. The launch of Google’s search engine on September 4, 1998<sup>644</sup> revolutionized how information is accessed on the internet. Google’s PageRank algorithm improved the relevance of search results, making it easier for users to find information.<sup>645</sup> This innovation promoted an open internet by allowing users to discover content from a wide variety of sources.<sup>646</sup> Before PageRank, search engines primarily relied on basic keyword matching, which often led to less relevant results. PageRank improved the relevance of search results by considering the quality and quantity of links to a page, effectively allowing the web itself to determine the importance of content.<sup>647</sup> This meant that even smaller, lesser-known websites could rank highly if they provided valuable content that others linked to, democratizing access to information and promoting a more level playing field for content creators. It also incentivized website owners to produce high-quality content that others would naturally want to link to. This led to an overall improvement in the quality of information available on the internet, as sites

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<sup>644</sup> “From the garage to the Googleplex,” *About Google*, available at [https://about.google/intl/ALL\\_us/our-story/](https://about.google/intl/ALL_us/our-story/); Kristi Ray, “The History Of Google Search,” *sitecentre*, February 28, 2024, available at <https://www.sitecentre.com.au/blog/history-of-google-search>.

<sup>645</sup> Sergey Brin, and Lawrence Page, “The anatomy of a large-scale hypertextual Web search engine,” *Computer Networks and ISDN Systems*, Vol. 30, No. 1-7, 1998, pp. 107-117.

<sup>646</sup> Google later became the first “Gold Sponsor” of the World Wide Web Consortium Organization W3C Sponsor program. The standards that W3C helps to develop “have enabled the creation of two billion websites, the emergence of flourishing business ecosystems, and made the Web accessible to more people, inclusive, and secure, ensuring that the web is accessible and open.” Google has also been involved in building the physical infrastructure for the open web. Google Fiber focuses on providing high speed internet to residences, and internet at no cost to non-profits and community organizations. See “W3C Welcomes Google and Adobe as First Organization Sponsors,” W3C, October 19, 2011, available at <https://www.w3.org/news/2011/w3c-welcomes-google-and-adobe-as-first-organization-sponsors/>; “About us,” W3C, available at <https://www.w3.org/about/>; “GFiber Facts,” Google Fiber, available at <https://fiber.google.com/google-fiber-facts/>.

<sup>647</sup> David Austin, “How Google Finds Your Needle in the Web’s Haystack,” *American Mathematical Society*, December 2006, available at <https://www.ams.org/publicoutreach/feature-column/fcarc-pagerank>.



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sought to earn links from reputable sources. By automating the ranking process and basing it on link analysis rather than human judgment, PageRank reduced the bias that might come from manual curation of content. This helped ensure that search results were more objective and comprehensive, giving users access to a wider variety of perspectives and sources. Over the years, Google has continuously updated its algorithms to combat link manipulation and spam, working to ensure the integrity of search results.<sup>648</sup>

203. Display advertising evolved against this backdrop. Beginning with direct negotiations between publishers and advertisers (known as *direct deals*), advertisers and publishers slowly incorporated more technology and automation over time. Early on, *publisher ad servers* developed to manage a publisher's ad slots (or *ad inventory*).<sup>649</sup> Then *ad networks* arose to sell packages of leftover ad slots, or *remnant inventory* (the ad slots that publishers could not sell via direct negotiations with advertisers) to interested advertisers.<sup>650</sup> At this time, publishers selected which ad network to sell to based on a publisher's static ranking of each network, known as the *waterfall*, typically set based on the agreed price between the publisher and the ad network.<sup>651</sup> This waterfall was industry-standard and remained in place for years. Over time, *ad exchanges* emerged, which allowed publishers to sell ad slots impression by impression through auctions.<sup>652</sup> Around this time, DoubleClick invented *Dynamic Allocation*, which increased publisher revenue by allowing bidders on DoubleClick's ad exchange to win an impression whenever they generated a higher yield than the waterfall.<sup>653</sup> Dynamic Allocation remained a part of DoubleClick's ad server (DFP) after Google acquired DoubleClick and as technology continued to evolve. Over time, ad exchanges grew in popularity after they began to offer advertisers *real-time bidding*, but publishers continued to use the waterfall in selecting which ad exchange (or ad

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<sup>648</sup> See, e.g., Patrick Stox, "The Evolution Of Google PageRank," *Ahrefs Blog*, June 27, 2024, available at <https://ahrefs.com/blog/google-pagerank/> (referencing initiatives like the introduction of the "nofollow" attribute in 2005 and the Penguin 4.0 algorithm in 2016, which have helped to minimize the impact of artificial link-building schemes and further promoted an open and fair internet).

<sup>649</sup> See Section VII.B.

<sup>650</sup> See Section VII.C.

<sup>651</sup> See Section VII.C.

<sup>652</sup> See Section VII.D.

<sup>653</sup> See Section VII.E.

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network) to call.<sup>654</sup> Subsequently, a technology called *header bidding* was developed that enabled publishers to run an auction among ad exchanges.<sup>655</sup> Introduced years earlier, DFP and Dynamic Allocation were not designed specifically for header bidding, so Google developed its own competing version, called *Open Bidding*, to meet customer demand for an auction among ad exchanges with fewer drawbacks than header bidding.<sup>656</sup> By 2019, Google modified Dynamic Allocation when it put all demand sources into a *Unified First Price Auction*.<sup>657</sup>

204. Dr. Chandler, Professor Gans, and Professor Weinberg summarize these decades of technological evolution,<sup>658</sup> but they fail to accurately characterize certain historical developments and therefore paint a misleading picture of Google’s conduct.

**A. In the early-to-mid 1990s, the emergence of the internet allowed publishers and advertisers to explore a new digital channel to reach their audiences.**

205. As Plaintiffs’ experts recognize, banner ads were among the earliest forms of digital advertising.<sup>659</sup> The first web banner ad appeared in Hotwired, a commercial online magazine, on October 27, 1994.<sup>660</sup> This was the first known direct deal in digital advertising: the advertiser (AT&T) agreed with the publisher (Hotwired) to purchase an ad slot from their inventory for a price of \$30,000.<sup>661</sup> The ad generated a click-through rate (CTR) of 44%.<sup>662</sup> By way of

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<sup>654</sup> See Section VII.G.

<sup>655</sup> See Section VII.I.

<sup>656</sup> See Section VII.J.

<sup>657</sup> See Section VII.K.

<sup>658</sup> Chandler Report, ¶¶ 24-28, Gans Report, ¶¶ 100-119, Expert Report of Matthew Weinberg, PhD, *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, June 7, 2024 (“Weinberg Report”), ¶¶ 61-100.

<sup>659</sup> Chandler Report, ¶ 28.

<sup>660</sup> A replica of the ad is available at <http://thefirstbannerad.com/>. A replica of the landing page of the ad is available at <http://thefirstbannerad.com/youidid.html>; “Netscape Communications Offers New Network Navigator Free On The Internet,” *Netscape*, October 13, 1994, available at <https://web.archive.org/web/20061207145832/http://wp.netscape.com/newsref/pr/newsrelease1.html>.

<sup>661</sup> Karla Hesterberg, “A Brief History of Online Advertising,” *HubSpot*, November 29, 2021, available at <https://blog.hubspot.com/marketing/history-of-online-advertising>.

<sup>662</sup> Karla Hesterberg, “A Brief History of Online Advertising,” *HubSpot*, November 29, 2021, available at <https://blog.hubspot.com/marketing/history-of-online-advertising>.



comparison, the average CTR of a display ad in recent years is now estimated to be between 0.02% and 2%.<sup>663</sup>

206. In the early days of display advertising, publishers contracted directly with advertisers and advertising agencies to sell inventory on their websites, replicating the traditional model used to sell ad space in print publications.<sup>664</sup> These “direct deals” typically involved advertisers paying on a CPM (also known as cost-per-thousand-impressions) basis.<sup>665</sup> Advertisers would send their ad creatives (*e.g.*, images) to publishers, and the publishers would then manually upload those ad creatives onto their websites.<sup>666</sup> **Figure 21** illustrates display ad sales through direct deals between publishers and advertisers.

**Figure 21. Direct Deals Replicate Offline Advertising**



**Notes:**

[1] This figure is reproduced as **Figure D-1** in **Appendix D**.

207. This traditional model of direct sales, however, led to inefficiencies when used to sell display ads. For example, publishers had difficulty predicting how many impressions would be generated within a specific time period, and because publishers could not guarantee advertisers more impressions than they could confidently predict, there was often unsold inventory, which

<sup>663</sup> “The History of Digital Advertising Technology,” Chapter 3 in *The Ad Tech Book*, Clearcode, available at <https://adtechbook.clearcode.cc/history-advertising-technology/>.

<sup>664</sup> “The History of Digital Advertising Technology,” Chapter 3 in *The Ad Tech Book*, Clearcode, available at <https://adtechbook.clearcode.cc/history-advertising-technology/>.

<sup>665</sup> “The History of Digital Advertising Technology,” Chapter 3 in *The Ad Tech Book*, Clearcode, available at <https://adtechbook.clearcode.cc/history-advertising-technology/>.

<sup>666</sup> “The History of Digital Advertising Technology,” Chapter 3 in *The Ad Tech Book*, Clearcode, available at <https://adtechbook.clearcode.cc/history-advertising-technology/>.

appeared as empty slots on websites where ads could have been placed.<sup>667</sup> Oversupply of inventory was exacerbated by the growth in the number of websites in this period.<sup>668</sup>

208. While the growth of the internet provided a new channel of advertising and expanded options for advertisers and publishers relative to the traditional offline world, it did not at first fundamentally change how advertising was bought and sold. Like print ads, digital ads were initially purchased through direct negotiations and based on the characteristics of the publications (here, websites) themselves, such as their contents (*e.g.*, financial institution banner ads appearing when users browsed Yahoo Finance website) or geographic region (*e.g.*, Yahoo Canada website).<sup>669</sup>

**B. In the mid-to-late 1990s, the emergence of ad servers enabled publishers to automate the delivery of display ads.**

209. In the mid-to-late 1990s, publishers and advertisers started to conduct direct advertising transactions through ad servers, as depicted in **Figure 22**, with the publisher and advertiser sides of ad tech products developing in parallel. *Publisher ad servers* developed to help publishers manage creatives from multiple direct deals, specify characteristics about available inventory to inform advertiser targeting decisions, and monitor campaign performance metrics (*e.g.*,

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<sup>667</sup> Mike Sweeney, “How Real-Time Bidding (RTB) Changed Online Display Advertising,” *Clearcode*, December 13, 2023, available at <https://clearcode.cc/blog/real-time-bidding-online-display-advertising/> (“Difficulties emerged when the number of websites, and therefore publishers, began to increase. The once-straightforward direct sales process started to become more complex, unhinged, and drawn-out. While Premium ads – those bought by advertisers directly from the publishers – were still common, publishers soon found that a lot of other available inventory wasn’t being filled and fell victim to oversupply.”).

<sup>668</sup> Mike Sweeney, “How Real-Time Bidding (RTB) Changed Online Display Advertising,” *Clearcode*, December 13, 2023, available at <https://clearcode.cc/blog/real-time-bidding-online-display-advertising/>.

<sup>669</sup> Katherine Gallagher, and Jeffrey Parsons, “A Framework for Targeting Banner Advertising On the Internet,” *Proceedings of The Thirtieth Annual Hawaii International Conference on System Sciences*, Vol. 4, 1997, pp. 265-274 at p. 267 (“At present, targeting of banner advertising does not always occur. [...] Nevertheless, online information services do currently provide some targeting capability. As of August 1996, both Yahoo! [...] and Excite [...] offered advertisers three options: general rotation, geographic or content targeting, and keyword-based targeting [for search]. With ‘general rotation,’ banner advertisements rotate randomly through user searches and browsing on the site. [...] Restricted rotations permit advertisers to purchase space in specified content areas or by geographic region. For example, financial institutions can limit the exposure of their banner advertisements to users searching or browsing Business categories, and Canadian advertisers can choose to have their banner advertisements shown only to users who are searching or browsing in the Yahoo! Canada site. These two options are analogous to the targeting offered by traditional media such as newspapers, magazines, television, and radio [...].”).

impressions, clicks).<sup>670</sup> The first publisher ad server was released by NetGravity on January 31, 1996,<sup>671</sup> and others followed, including DoubleClick for Publishers (DFP), which was subsequently acquired by Google and later incorporated into Google Ad Manager.<sup>672</sup>

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<sup>670</sup> “The History of Digital Advertising Technology,” Chapter 3 in *The Ad Tech Book*, Clearcode, available at <https://adtechbook.clearcode.cc/history-advertising-technology/>; Maciej Zawadziński, and Mike Sweeney, “What is an Ad Server and How Does It Work?” Clearcode, May 20, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-server/>.

<sup>671</sup> “NetGravity Launches AdServer, the Premier Advertising Management System Software for World Wide Web Publishers,” *NetGravity*, January 31, 1996, available at <http://web.archive.org/web/19961112043013/www3.netgravity.com/news/pressrel/launch.html>.

<sup>672</sup> Jonathan Bellack, “Introducing Google Ad Manager,” *Google Ad Manager*, June 27, 2018, available at <https://blog.google/products/admanager/introducing-google-ad-manager/> (“Not just an ad server or Sell-Side Platform (SSP)—a complete ad platform”); Sridhar Ramaswamy, “Introducing simpler brands and solutions for advertisers and publishers,” *Google The Keyword*, June 27, 2018, available at <https://www.blog.google/technology/ads/new-advertising-brands/>.

**Figure 22. Publishers and Advertisers Adopt Ad Servers to Manage Display Advertising Processes**



**Notes:**

[1] Advertisers could also use advertiser ad servers to manage the process of organizing and serving their ad creatives to different websites, as well as tracking the performance of their ad campaigns across multiple websites. See Maciej Zawadziński, and Mike Sweeney, “What is an Ad Server and How Does It Work?” *Clearcode*, May 20, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-server/>.

[2] I exclude advertiser ad servers from all graphics in this report, as I understand they are not part of the relevant products alleged by Plaintiffs.

[3] This figure is reproduced as **Figure D-2** in **Appendix D**.

210. Publishers can either develop ad servers internally or source them from third-party vendors.<sup>673</sup> An illustrative and non-exhaustive list of companies beyond Google that operate a publisher ad server or that provide publisher ad server services today includes Microsoft (Xandr),<sup>674</sup> Disney,<sup>675</sup> LinkedIn,<sup>676</sup> Snapchat,<sup>677</sup> Reddit,<sup>678</sup> Amazon,<sup>679</sup> FreeWheel,<sup>680</sup> Magnite,<sup>681</sup> Equativ,<sup>682</sup> Kevel,<sup>683</sup> AppLovin,<sup>684</sup> and Unity,<sup>685</sup> among others.

<sup>673</sup> “Ad Servers and how they work,” *Amazon Ads*, available at <https://advertising.amazon.com/library/guides/ad-server>.

<sup>674</sup> “About Microsoft Monetize,” *Xandr Platform*, May 10, 2024, available at <https://learn.microsoft.com/en-us/xandr/monetize/about-monetize>; see also Gans Report, ¶ 355.

<sup>675</sup> The Disney Ad Server (DAS) gives Disney direct control over the core ad-decisioning mechanics. It also includes a Yield Optimization Delivery Allocation (YODA) tool, which allows programmatic buys to compete with direct sales. See Todd Spangler, “Why Disney Built Its Own Ad Server for Disney+ and Hulu — and What the YODA Does,” *Variety*, January 22, 2023, available at <https://variety.com/2023/digital/news/disney-ad-server-tech-disney-plus-yoda-1235497663/>; Alyssa Boyle, “Disney Ups The Ante On Targeting And Measurement Ahead Of The 2023 Upfronts,” *AdExchanger*, January 24, 2023, available at <https://www.adexchanger.com/digital-tv/disney-ups-the-ante-on-targeting-and-measurement-ahead-of-the-2023-upfronts/>.

<sup>676</sup> GOOG-DOJ-04630300 at 300 (discussing LinkedIn’s plans to “sunset [DFP] by end of [2016]”); GOOG-AT-MDL-014736719 at 722 (confirming LinkedIn’s operation of an in-house publisher ad server in 2018).

<sup>677</sup> [REDACTED]

<sup>678</sup> [REDACTED]

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211. Nowadays, a publisher ad server manages a publisher's display ad inventory and runs algorithms that help the publisher decide which ad to serve and where the ad should be displayed. The decision is based on any direct deals between the publisher and advertiser as well as the results of programmatic sales processes carried out through the other components discussed below.<sup>686</sup>

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<sup>679</sup> GOOG-DOJ-05222694 at 694 (“Completed migrating AMZN proper sites off DFP to internal ad server as expected.”); *see also* Chandler Report, ¶ 159.

<sup>680</sup> FreeWheel, founded in 2007 and acquired by Comcast in 2014, offers a supply suite that enables publishers to connect directly to buyers, provides unified ad delivery, and enhances monetization across all inventory. *See* Ryan Lawler, “Comcast Is Acquiring Video Ad Company FreeWheel For \$320 Million,” *TechCrunch*, March 1, 2014, available at <https://techcrunch.com/2014/03/01/comcast-freewheel/>; “Comcast buys advertising startup Freewheel for \$360 million,” *Reuters*, March 6, 2014, available at <https://www.reuters.com/article/idUSL1N0M31GL/>; “For Sellers: SupplySuite,” *FreeWheel*, available at <https://www.freewheel.com/supplysuite>.

<sup>681</sup> Magnite has a “state-of-the-art ad server,” SpringServe, which it acquired in 2021. *See* “You work hard to build your audience. Together, we’ll make every impression count.” *Magnite*, available at <https://www.magnite.com/Sellers/>; “Magnite Acquires SpringServe, A Leader in CTV Ad Serving Technology,” *Magnite*, July 1, 2021, available at <https://investor.magnite.com/news-releases/news-release-details/magnite-acquires-springserve-leader-ctv-ad-serving-technology>; *see also* Gans Report, ¶ 141, Footnote 113.

<sup>682</sup> Founded in 2006, Smart AdServer rebranded as “Equativ” after its acquisitions of DynAdmic and LiquidM. Equativ offers publishers an integrated SSP and Ad Server, providing optimized yield and operational efficiency. *See* Marisa Nelson, “Smart AdServer Rebrands as Equativ,” *Equativ*, June 8, 2022, available at <https://equativ.com/blog/press-release/smart-adserver-rebrands-as-equativ/>; “Monetization Is Our Mission,” *Equativ*, available at <https://equativ.com/solutions/earn/>; *see also* Gans Report, ¶ 141.

<sup>683</sup> Founded as Adzerk in 2010, “Kevel’s APIs provide the core infrastructure for ad serving, targeting, and reporting” including management of all demand, including direct sold, on a single platform. *See* “Helping brands take back the Internet since 2010,” *Kevel*, available at <https://www.kevel.com/about>; “The power of API ad serving in your hands,” *Kevel*, available at <https://www.kevel.com/ad-platform>; *see also* Gans Report, ¶ 361 (“Kevel, the self-hosted publisher ad server provider”), Footnote 113; Chandler Report, ¶ 159.

<sup>684</sup> In 2022, AppLovin acquired MoPub, a publisher ad server formerly owned by Twitter. *See* Adam Foroughi, “AppLovin’s Acquisition of MoPub Has Officially Closed,” *AppLovin*, January 3, 2022, available at <https://www.applovin.com/blog/applovin-acquisition-of-mopub-has-officially-closed/>.

<sup>685</sup> “Mobile app advertising networks: Integration,” *ironSource*, available at <https://www.is.com/mobile-ad-network/> (describing the process of how ironSource serves an ad through its ad server). ironSource merged with Unity in 2022. *See* “Get to know us,” *ironSource*, available at <https://www.is.com/about/>; *see also* Gans Report, Footnote 113.

<sup>686</sup> *See, e.g.*, Maciej Zawadziński, and Mike Sweeney, “What is an Ad Server and How Does It Work?” *Clearcode*, May 20, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-server/>; Alise Zaiceva, “What is an Ad Server & 10 Best Ad Servers for Publishers,” *Setupad Blog*, April 17, 2024, available at <https://setupad.com/blog/ad-server/>.

**C. From the mid-1990s to the early 2000s, ad networks emerged as brokers to help publishers sell remnant inventory in a waterfall system.**

212. Although ad servers allowed publishers to manage direct deals with advertisers, publishers continued to hold an ever-expanding amount of online inventory that they were not able to sell by direct deals. These leftover ad slots are known as *remnant inventory*.<sup>687</sup> In the mid-1990s, *ad networks* emerged as a tool to help sell these leftover ad slots. To do so, some ad networks purchased remnant inventory from multiple publishers and aggregated the inventory into packages to sell to advertisers,<sup>688</sup> while other ad networks could transact impressions on a non-guaranteed basis.<sup>689</sup> As a result, ad networks allowed publishers to sell more inventory to advertisers (and thereby reduce unsold inventory) without spending more time on one-on-one negotiations.<sup>690</sup>

213. The first ad networks included WebConnect (introduced in 1995),<sup>691</sup> DoubleClick (founded in 1995),<sup>692</sup> and 24/7 Real Media (founded in 1995).<sup>693</sup> **Figure 23** illustrates how ad networks worked to facilitate the sale of remnant inventory.

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<sup>687</sup> Remnant inventory means inventory that was not sold via a publisher's direct deals with advertisers. *See* "Remnant inventory," *Clearcode*, available at <https://clearcode.cc/glossary/remnant-inventory/>.

<sup>688</sup> *See, e.g.*, Maciej Zawadziński, and Mike Sweeney, "What Is an Ad Network and How Does It Work?" *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-network-and-how-does-it-work/> ("An ad network is a technology platform that serves as a broker between a group of publishers and a group of advertisers [...] helping advertisers buy available ad space (aka inventory) across multiple platforms.").

<sup>689</sup> GOOG-DOJ-03515429 at 468.

<sup>690</sup> *See, e.g.*, "Ad Networks vs Ad Exchanges: The History of Programmatic Advertising," *AdButler*, March 15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising>.

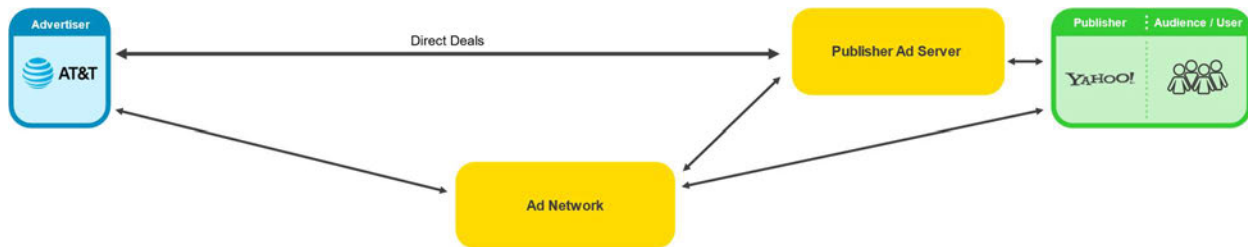
<sup>691</sup> Maciej Zawadziński, "The history of Advertising Technology," *Clearcode*, May 8, 2015, available at <https://www.slideshare.net/clearcode/the-history-of-advertising-technology>, at slide 14; "46. Jay Schwedelson – was WebConnect the first ad network?" *Paleo Ad Tech*, December 10, 2023, available at <https://paleoadtech.com/2022/10/06/46-jay-schwedelson-was-webconnect-the-first-ad-network/>.

<sup>692</sup> J.J. Colao, "Gilt, MongoDB, DoubleClick: Meet The Duo Behind New York's Biggest Tech Companies," *Forbes*, July 24, 2013, available at <https://www.forbes.com/sites/jjcolao/2013/07/24/gilt-10gen-doubleclick-meet-the-duo-behind-new-yorks-most-successful-tech-companies/?sh=67042d9930c4> ("Three years later, in 1995, DoubleClick was born in O'Connor's basement."). DoubleClick sold its ad network business to L90 in 2002 as part of a strategy to focus on its advertising technology and data analysis business. *See, e.g.*, Bob Tedeschi, "DoubleClick Sells Its Media Sales Business to L90," *The New York Times*, July 1, 2002, available at <https://www.nytimes.com/2002/07/01/business/doubleclick-sells-its-media-sales-business-to-l90.html>.

<sup>693</sup> 24/7 Real Media started serving ads in 1994 and formally founded in 1995. It went public in July 1998. *See* "WPP Acquires 24/7 Real Media for \$649m," *TechCrunch*, May 17, 2007, available at

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**Figure 23. Ad Networks Aggregate and Resell Remnant Inventory**



**Notes:**

[1] This figure is reproduced as **Figure D-3** in **Appendix D**.

214. Ad networks provided services to both publishers and advertisers. On the publisher side, ad networks attracted publishers by providing a more cost-effective way than a direct sales team to package and sell the remnant inventory that otherwise would have been hard to sell.<sup>694</sup> On the advertiser side, ad networks attracted advertisers by promising access to a wide selection of trusted publishers and the ability to target their ads to specific audiences.<sup>695</sup>

<https://techcrunch.com/2007/05/17/wpp-acquires-247-real-media-for-649m/>; “24/7 Real Media Inc.,” *SEC Info*, July 24, 1998, available at <https://www.secinfo.com/dsVsd.716v.htm>.

<sup>694</sup> DoubleClick Inc., Form 10-K/A for the Year Ended December 31, 1998, *SEC*, April 27, 1999, available at <https://www.sec.gov/Archives/edgar/data/1049480/0001047469-99-016398.txt> (“The DoubleClick Network provides fully-outsourced ad sales, delivery and related services to publishers of highly-trafficked Web sites, including AltaVista, The Dilbert Zone, Macromedia and U.S. News Online.”); 24/7 Media Inc., Form 10-K for the Fiscal Year Ended December 31, 1998, *SEC*, March 31, 1999, available at <https://www.sec.gov/Archives/edgar/data/1062195/0000950146-99-000653.txt> (“Membership in our networks enables Web publishers to generate advertising revenues by gaining access to advertisers and direct marketers without the costs and challenges associated with building and maintaining their own ad sales force and ad serving technology. Web sites included on our networks benefit from our experienced management team, our extensive sales and marketing organization and our direct access to advertisers and agencies.”).

<sup>695</sup> DoubleClick Inc., Form 10-K/A for the Year Ended December 31, 1998, *SEC*, April 27, 1999, available at <https://www.sec.gov/Archives/edgar/data/1049480/0001047469-99-016398.txt> (“Web publishers seeking to add their Web sites to the DoubleClick Network must meet defined inclusion and maintenance criteria based upon, among other things, the demographics of the particular Web site’s users, the Web site’s content quality and brand name recognition, the level of existing and projected traffic on the Web site, and/or the opportunity to provide sponsorship opportunities. By preserving the integrity of the DoubleClick Network through the maintenance of such defined criteria, DoubleClick enhances an advertiser’s ability to have its advertisements seen by the appropriate audience.”); 24/7 Media Inc., Form 10-K for the Fiscal Year Ended December 31, 1998, *SEC*, March 31, 1999, available at <https://www.sec.gov/Archives/edgar/data/1062195/0000950146-99-000653.txt> (“We reduce costs and ease time pressures for advertisers and direct marketers by alleviating the need to purchase a series of ad campaigns from numerous Web publishers. Our networks provide advertisers and direct marketers with access to a wide variety of online content and a broad reach of Internet users. Advertisers and direct marketers can enhance the effectiveness of advertising and direct marketing campaigns by customizing their ad delivery on our networks and buying ad space either on selected Affiliated Web sites, within a particular content channel or across an entire network.”).



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215. As the number of websites on the internet continued to increase, many ad networks emerged, and publishers began using multiple ad networks to sell remnant inventory.<sup>696</sup> There were hundreds of ad networks, ranging from ad networks serving general audiences to ad networks catering to specific industry sectors—for example, selling packages of inventory from sports websites.<sup>697</sup>

216. With so many ad networks to choose from, publishers needed a way to allocate inventory among them. That challenge led to the *waterfall*, which was a way that publishers would set up their ad servers to first determine if they could fill an impression through a guaranteed direct sale,<sup>698</sup> and if not, offer the remnant inventory to each of their chosen ad networks, one at a time in specified order.<sup>699</sup> To do so:

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<sup>696</sup> Maciej Zawadziński, and Mike Sweeney, “What Is an Ad Network and How Does It Work?” *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-network-and-how-does-it-work/> (“In the early days of online advertising when there were fewer sites and advertisers, most publishers would only use one ad network to sell remnant inventory. However, as the number of publisher sites increased, they soon found that they weren’t able to sell all of their inventory on one ad network and suffered from low fill rates. In an attempt to increase fill rates, publishers started using multiple ad networks, some of them offering premium inventory and others offering remnant inventory.”).

<sup>697</sup> “Interview with Frank Addante, Rubicon Project,” *socalTECH*, October 8, 2007, available at [https://socaltech.com/interview\\_with\\_frank\\_addante\\_rubicon\\_project/s-0011613.html](https://socaltech.com/interview_with_frank_addante_rubicon_project/s-0011613.html) (“From Google AdSense, to Tacoda, to AdBrite, to 24/7, to HispanoClick in Mexico—there are 300 ad networks. Seven years ago, there were fifteen ad [networks]. Two years ago, there were 150 networks—now there are 300. There are large networks, small networks, CPA networks, CPC networks, local networks, networks focused on certain geographies, a sports network, a woman network, a gay ad network.”).

<sup>698</sup> In a guaranteed direct deal, a publisher and an advertiser directly negotiate prices and terms for inventory that is reserved or “guaranteed” for the advertiser. See “Programmatic Guaranteed vs. Preferred Deals,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/7637485?hl=en>.

<sup>699</sup> GOOG-AT-MDL-007178292 (Deposition of [REDACTED], *In Re Google Antitrust Litigation*, August 12, 2021) at 325:2-16 (“Q. What is a waterfall? [...] A. For ad tech[,] a waterfall refers to the process whereby a network is called, the network sees if it has a bid for a buyer for the particular inventory, and if not, calls another network that would then see if it has a buyer for the inventory. And if not, it would call another network or system []. So the idea was you’re checking do you want to buy it? Do you want to buy it? Do you want to buy it? As it goes through that process.”), 363:16-364:1 (“Q. And in the DFP system, the publisher could set different line items for different exchanges? A. So in the original design of the system, it was not designed to put exchanges in as line items. Line items are designed to represent direct deals or network deals. Q. But did that change over time? A. It was never changed so that it was designed to handle a dynamic thing like an exchange. It was always designed to handle a static line item up until exchange bidding.”); Maciej Zawadziński, and Mike Sweeney, “What Is an Ad Network and How Does It Work?” *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-network-and-how-does-it-work/> (“In an attempt to increase fill rates, publishers started using multiple ad networks, some of them offering premium inventory and others offering remnant inventory. This situation where ad networks are called one after another is known as waterfalloing.”); Maciej Zawadziński, and Mike Sweeney, “What is Waterfalloing and How Does it Work?” *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/what-is-waterfalloing/> (“Waterfalloing, also known as a daisy chain or waterfall tags, is a process used by a publisher to sell all remnant inventory. This process occurs when a



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- A publisher would set, in advance, its order of preference of ad networks, often based on a static price agreed between the publisher and the ad network.
- When an impression became available for sale, the publisher would sequentially call these ad networks in its preferred order to offer the impression for sale.
- If the first ad network could fill the impression with an ad, the impression was sold to that network.
- If the ad network declined to fill the impression, the publisher offered it to the next ad network on the list, with that allocation repeating until the impression was filled or the end of the publisher's list of ad networks was reached.

217. While the waterfall system was an innovation when it was first developed and remained in use for years, the technology initially only enabled publishers to obtain static prices from ad networks<sup>700</sup>; the technology that enabled dynamic pricing for ad inventory only came later.<sup>701</sup>

218. The waterfall system was the industry standard way of selling publisher inventory in the 2000s.<sup>702</sup> As Dr. Chandler describes, it “reflect[ed] the industry’s response to the need for more

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publisher has been unable to sell its premium ad slots that are usually reserved for direct ad sales between the publisher’s internal sales team and advertisers. Waterfalling gets its name from the waterfall-like process for selling inventory — i.e. the demand sources are initiated one at a time, one after another. [...] [T]he publisher first tries to sell its inventory via direct sales, as these generally offer the highest cost-per mille (CPM). If it is unable to do so, the publisher will then pass the impression down the waterfall to various ad networks until it is sold.”).

<sup>700</sup> While ad networks at this time typically used contract pricing, some ad networks were auction-based. *See, e.g.,* GOOG-AT-MDL-007178292 (Deposition of [REDACTED], *In Re Google Antitrust Litigation*, August 12, 2021) at 352:11-25 (“AdSense was, at the time back in 2008, an ad network [...] AdSense ran an auction, 2008.”).

<sup>701</sup> GOOG-AT-MDL-007178292 (Deposition of [REDACTED], *In Re Google Antitrust Litigation*, August 12, 2021) at 363:16-364:1 (“Q. And in the DFP system, the publisher could set different line items for different exchanges? A. So in the original design of the system, it was not designed to put exchanges in as line items. Line items are designed to represent direct deals or network deals. Q. But did that change over time? A. It was never changed so that it was designed to handle a dynamic thing like an exchange. It was always designed to handle a static line item up until exchange bidding.”); “Line items: About line items,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/9405477?hl=en> (“Line items contain information about how specific ad creatives are intended to serve to your website or app along with pricing and other delivery details.”).

<sup>702</sup> [REDACTED]

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efficient and effective ad buying processes.”<sup>703</sup> It was not invented by Google, and it was used by publishers before Google even acquired DoubleClick.<sup>704</sup>

219. Despite working with ad networks, publishers continued to hold unsold remnant ad inventory. Moreover, ad networks’ limited targeting and tracking capabilities proved challenging for advertisers, who had only limited ability to compare the effectiveness of their campaigns and optimize their spending across different ad networks.<sup>705</sup> This led to the rise of ad exchanges and later real-time bidding (RTB) protocols, which I discuss in **Sections VI.D** and **VI.G**.

220. Today, ad networks can connect advertisers directly to publishers, and they can also buy ad inventory for their advertiser customers indirectly by bidding into ad exchanges on behalf of advertisers.<sup>706</sup>

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[REDACTED]

[REDACTED]

[REDACTED] Alise Zaiceva,  
“Header Bidding vs Waterfall | Differences Explained,” *Setupad Blog*, July 13, 2021, available at <https://setupad.com/blog/header-bidding-vs-waterfall/>. See also Gans Report, ¶ 95 (“In the early days of online display advertising, the most widely used routing logic was the Waterfall process.”).

<sup>703</sup> Chandler Report, ¶ 102.

<sup>704</sup> Google acquired DoubleClick’s publisher ad server in 2008. See “Google Closes Acquisition of DoubleClick,” *Google*, March 11, 2008, available at [https://googlepress.blogspot.com/2008/03/google-closes-acquisition-of\\_11.html](https://googlepress.blogspot.com/2008/03/google-closes-acquisition-of_11.html).

<sup>705</sup> Mike Sweeney, “How Real-Time Bidding (RTB) Changed Online Display Advertising,” *Clearcode*, December 13, 2023, available at <https://clearcode.cc/blog/real-time-bidding-online-display-advertising/> (“For advertisers, this also created challenges. They soon found that they weren’t able to reach their target audience by using just one ad network, so they started buying inventory from multiple ad networks and advertising exchanges. However, buying inventory from multiple parties (e.g. ad networks and ad exchanges) meant they often bought the same audience more than once, lacked clear insights into the effectiveness of their ads, and struggled to identify their best-performing inventory.”); “The History of Digital Advertising Technology,” Chapter 3 in *The Ad Tech Book*, *Clearcode*, available at <https://adtechbook.clearcode.cc/history-advertising-technology/>.

<sup>706</sup> Anete Jodzevica, “Ad Exchange – Complete Guide for Publishers and Advertisers,” *Setupad Blog*, April 21, 2023, available at <https://setupad.com/blog/what-is-an-ad-exchange/> (“An ad network collects ad inventory directly from publishers or buys ad impressions in bulk from ad exchanges. After, they sort and group these ad spaces to resell them to advertisers.”).

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221. An illustrative and non-exhaustive list of companies that operate ad networks today includes Meta,<sup>707</sup> Microsoft,<sup>708</sup> Criteo,<sup>709</sup> Taboola,<sup>710</sup> Outbrain,<sup>711</sup> Vox Media,<sup>712</sup> AppLovin,<sup>713</sup> and Unity.<sup>714</sup>

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<sup>707</sup> Meta’s ad network is called Meta Audience Network (formerly Facebook Audience Network). See “About Meta Audience Network,” *Meta Business Help Center*, available at <https://www.facebook.com/business/help/788333711222886?id=571563249872422>; Alex Spencer, “Facebook Opens Up Audience Network Header Bidding,” *Sonobi*, March 30, 2017, available at <https://sonobi.com/press-release/facebook-opens-audience-network-header-bidding/> (“Facebook has opened up Audience Network, the third-party ad network it introduced in 2014, to mobile web publishers.”); “Why Facebook embraced the ad network model,” *Digiday*, September 15, 2016, available at <https://digiday.com/media/facebook-audience-network/> (“The growth of programmatic advertising was supposed to mean the death of the ad network. Facebook is proving that wrong, building an ad network that is a \$1 billion business with 3 million advertisers and an undisclosed number of publishers, and it’s growing by rejecting many of the beliefs held sacred by the ad tech world.”); see also Gans Report, ¶ 619 (“Facebook launched its ad network Audience Network (FAN) in 2014. FAN allows marketers to buy ads on the open web using Facebook data.”).

<sup>708</sup> Microsoft’s ad network is called Microsoft Audience Network. See “Microsoft Display and Native ads,” *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en-us/solutions/microsoft-audience-network>; Mallory Harwood, “10 reasons why the Microsoft Audience Network is a must-buy,” *Microsoft Advertising Blog*, June 30, 2022, available at <https://about.ads.microsoft.com/en-us/blog/post/june-2022/10-reasons-why-the-microsoft-audience-network-is-a-must-buy>.

<sup>709</sup> [REDACTED]

<sup>710</sup> Taboola, founded in 2007, is one of the most well-known players focused on offering ads that blend with the content of a publisher. See “Reach Your Customers On Websites They Trust,” *Taboola*, available at <https://www.taboola.com/>; Jairene Cruz-Eusebio, “Taboola Native Ads Network: Your 5 Main Questions Answered,” *Brax*, December 14, 2021, available at <https://www.brax.io/blog/taboola-native-ads-network-your-5-main-questions-answered>.

<sup>711</sup> Outbrain, founded in 2006, is another example of a native ad network. See “A Company Built On Innovation, Leadership & Success,” *Outbrain*, available at <https://www.outbrain.com/about/company/>.

<sup>712</sup> Taylor Peterson, “Vox Media’s new ad network connects advertisers to local media audiences,” *MarTech*, March 11, 2020, available at <https://martech.org/vox-medias-new-ad-network-connects-advertisers-to-local-media-audiences/> (“Vox Media has launched Concert Local, an advertising solution designed to help brands scale regional messaging by connecting them with publishers and smaller media brands at the local level.”).

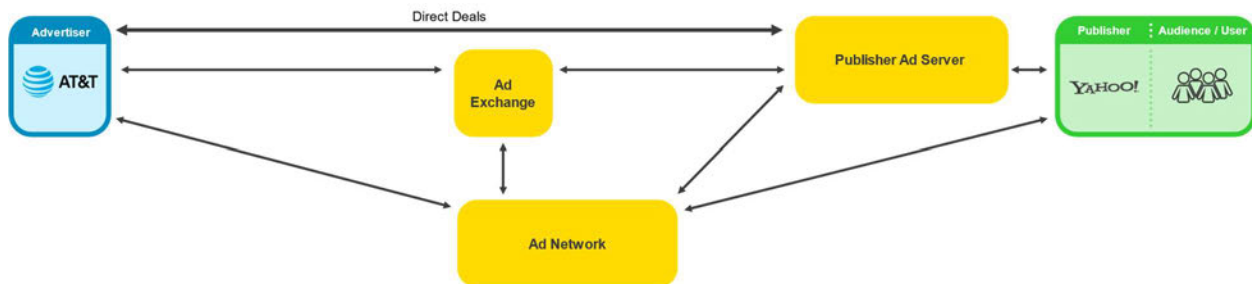
<sup>713</sup> Founded in 2012, AppLovin is an ad network that connects advertisers to audiences in-app, on mobile devices and across CTV. See “Investor FAQs,” *AppLovin*, available at <https://investors.applovin.com/resources/investor-faqs/>; “Connect with your audience,” *AppLovin*, available at <https://www.applovin.com/>.

<sup>714</sup> Unity, founded in 2004, offers ad tech products/services including mobile app analytics and monetization. See “Grow Your Mobile App With Unity Ads,” *Unity*, available at <https://unity.com/products/unity-ads>.

**D. Around 2005-2007, the first ad exchanges emerged to provide an auction process for buying and selling ads, but bids did not occur in “real time” and the waterfall largely remained in place.**

222. The mid-2000s saw large increases in the total number of websites and the volume of internet traffic, which further exacerbated the oversupply of remnant inventory.<sup>715</sup> As depicted in **Figure 24**, between 2005 and 2007, *ad exchanges* emerged to address this imbalance.<sup>716</sup>

**Figure 24. Ad Exchanges Enable Programmatic Transactions**



**Notes:**

[1] This figure is reproduced as **Figure D-4** in **Appendix D**.

223. Ad exchanges enabled publishers to sell and advertisers to purchase display advertising through automated auction processes that required significantly less manual effort.<sup>717, 718</sup>

<sup>715</sup> “Ad Networks vs Ad Exchanges: The History of Programmatic Advertising,” *AdButler*, March 15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising> (“as more websites came online, the manual nature of selling ads, even with the assistance of ad networks, was cumbersome enough to leave many publishers with unsold ad space.”).

<sup>716</sup> Yahoo Advertising Solutions Editorial, “Right Media Exchange,” *Yahoo! News*, April 2, 2012, available at <https://news.yahoo.com/article/right-media-exchange.html> (“Right Media launched the first global exchange for premium digital advertising in 2005.”); “Microsoft Acquires Advertising Exchange Platform AdECN,” *TechCrunch*, July 26, 2007, available at <https://techcrunch.com/2007/07/26/microsoft-acquires-advertising-exchange-platform-adeqn/>; “Ad Networks vs Ad Exchanges: The History of Programmatic Advertising,” *AdButler*, March 15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising>.

<sup>717</sup> Mike Sweeney, “What is Programmatic Advertising? The Definitive Guide for 2024,” *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/programmatic-advertising/> (“Programmatic advertising is defined as the process of automating the purchase, sale, delivery, and measurement of digital advertising campaigns via advertising technology (AdTech) platforms. These AdTech platforms allow advertisers, publishers, and agencies to create, run, and optimize ad campaigns with minimal human involvement.”).

<sup>718</sup> When ad networks first emerged, the process of ad selling was manual and human-operated (*i.e.*, non-automated). See “Ad Networks vs Ad Exchanges: The History of Programmatic Advertising,” *AdButler*, March

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Although glossed over by Plaintiffs' experts,<sup>719</sup> ad exchanges initially did not enable buyers to bid on individual impressions based on real-time information about an impression (what has become known as real-time bidding).<sup>720</sup> Rather, in the early years, ad exchanges operated using a "static" bidding model, where buyers—typically ad networks and large ad agencies<sup>721</sup>—submitted fixed bids for the future purchase of ad slots, based on limited targeting categories, such as time-of-day, day-of-week, geographic location, and site category and rating.<sup>722</sup> Although

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15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising>; "Ad network," *AppsFlyer*, available at <https://www.appsflyer.com/glossary/ad-network/>. Later on, some ad networks started to offer programmatic (*i.e.*, automated) advertising (*e.g.*, Google AdSense). *See* Alise Zaiceva, "Google AdX vs Google AdSense | Differences Explained," *Setupad Blog*, December 16, 2021, available at <https://setupad.com/blog/adsense-vs-ad-exchange/> ("On the other hand, Google AdSense is neither an SSP nor a DSP but an ad network that connects publishers with Google Ads advertisers to display programmatic ads."); Maciej Zawadziński, and Mike Sweeney, "What Is an Ad Network and How Does It Work?" *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-network-and-how-does-it-work/> ("Programmatic direct is a new, alternative solution to ad networks that makes the sale of display advertising less complex, and cheaper. It automates the process of direct ad-buying for campaigns.").

<sup>719</sup> *See, e.g.*, Chandler Report, ¶ 183 ("Ad exchanges are the place where advertisers and publishers come together to buy and sell ad inventory, in the form of impressions, in real-time auctions.").

<sup>720</sup> "Ad Networks vs Ad Exchanges: The History of Programmatic Advertising," *AdButler*, March 15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising> ("Traditionally ad exchanges forced advertisers to purchase ad impressions in bulk at a fixed price, despite the value of different ad space being worth more or less to certain advertisers.").

<sup>721</sup> GOOG-DOJ-06570825 at 828 ("We're in the process of migrating ad networks and publishers from the original [DoubleClick] Ad Exchange to the new version. The new Ad Exchange already includes over 40 ad networks from the US and Europe, including most of the 25 largest ad networks in the US (ranked by ComScore, April 2009). It also already contains variety of large premium publishers including newspapers, large portals, entertainment and branded sites."); Stephanie Clifford, "Ad exchanges come into their own," *The New York Times*, July 28, 2008, available at <https://www.nytimes.com/2008/07/28/business/worldbusiness/28iht-adco29.1.14825933.html> ("Last month, the advertising holding company Publicis Groupe said it would start working with DoubleClick and Right Media's exchange to buy advertisements. Two advertising companies, Havas Digital and WPP, have announced similar deals with Right Media in recent months.").

<sup>722</sup> "The Power of Real-Time Decisioning in the Online Advertising Marketplace," *DataXu Insights*, September 14, 2009, available at [https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu\\_wp\\_091409.pdf](https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu_wp_091409.pdf); "Real-Time Bidding," *DataXu*, September 22, 2009, available at <https://web.archive.org/web/20090922214534/http://www.dataxu.com/bidding.php>; "Real-Time Bidding: The Ad Exchange Leaps," *AdExchanger*, May 5, 2009, available at <https://www.adexchanger.com/ad-exchange-news/real-time-bidding-rtb-display-ad-exchange/> ("At the very least, if you think of an ad exchange as an ad server, well, then the ad gets served in real-time – as soon as the page is opened by the end user. But, no [...], we're not talking about that... For the most part, it's been a 'futures' or 'reserved' world to-date where buyers of online display ad media bid on publisher placements in the future. And, the advertiser must blindly trust, for example, that certain targeting parameters for any buy are implemented correctly by the selling publisher or ad network."); "AdECN is the first real-time, auction-based exchange for online display advertising," *AdECN Exchange*, May 20, 2006, available at <https://web.archive.org/web/20060520220126/adecn.com/> ("Advertisers specify in advance how much they are willing to pay based on the visitor's profile, or the visitor's past behavior, or the page content, or other factors. Advertisers can bid on a CPM, CPC, CPA, or CPL basis. Publishers are always paid on a CPM basis.").

a publisher could offer individual ad impressions for sale on an ad exchange one-by-one and in real time (*i.e.*, as users were browsing the website), the auction would then occur based on pre-set bids that buyers had submitted in advance.<sup>723</sup>

224. This early-stage ad exchange auction system nevertheless was more efficient than transacting with ad networks in a sequential waterfall process; publishers' ability to sell impressions in an auction meant that transactions more closely reflected the value of each ad impression.<sup>724</sup> Among the first ad exchanges were Right Media, AdECN, and DoubleClick Ad Exchange.<sup>725</sup>

225. Over time, ad exchanges provided more automation and accessibility for publishers to sell their ad inventory.<sup>726</sup> As I discuss further in **Section VII.G**, with the advent of additional technological advancements, including enhanced targeting and tracking capabilities, the next generation of ad exchanges evolved to offer real-time bidding, which later allowed advertisers to bid on each individual impression based on real-time information, rather than bidding on impressions based on preset bid values.

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<sup>723</sup> "The Power of Real-Time Decisioning in the Online Advertising Marketplace," *DataXu Insights*, September 14, 2009, available at [https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu\\_wp\\_091409.pdf](https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu_wp_091409.pdf); "Real-Time Bidding," *DataXu*, September 22, 2009, available at <https://web.archive.org/web/20090922214534/http://www.dataxu.com/bidding.php>.

<sup>724</sup> "The Power of Real-Time Decisioning in the Online Advertising Marketplace," *DataXu Insights*, September 14, 2009, available at [https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu\\_wp\\_091409.pdf](https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu_wp_091409.pdf); Pedro Ponce de Leon, "Get Real (Time)," *Right Media Blog*, August 27, 2009, available at <https://web.archive.org/web/20100305171119/http://www.rightmediablog.com/blog/2009/08/27/get-real-time> ("media exchanges like Right Media had technology that facilitated the selling of inventory on a per-impression basis").

<sup>725</sup> Shuai Yuan, Ahmad Zainal Abidin, Marc Sloan, and Jun Wang, "Internet Advertising: An Interplay among Advertisers, Online Publishers, Ad Exchanges and Web Users," *Arxiv*, 2012, available at <https://arxiv.org/pdf/1206.1754.pdf>; Stephanie Clifford, "Leftover Ad Space? Exchanges Handle the Remnants," *The New York Times*, July 28, 2008, available at <https://www.nytimes.com/2008/07/28/business/media/28adco.html>; "Ad Networks vs Ad Exchanges: The History of Programmatic Advertising," *AdButler*, March 15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising>.

<sup>726</sup> "Ad Networks vs Ad Exchanges: The History of Programmatic Advertising," *AdButler*, March 15, 2021, available at <https://www.adbutler.com/blog/article/ad-networks-vs-ad-exchanges-the-history-of-programmatic-advertising>.



**E. In 2007, DoubleClick invented Dynamic Allocation to increase competition for ad inventory in its publisher ad server (before Google acquired the company).**

226. As described above, the industry standard in the mid-2000s was for publishers to sell their remnant inventory by reaching out to demand sources in a waterfall sequence configured by the publisher based on static prices. In 2007, DoubleClick—an early ad tech company that offered a publisher ad server (DoubleClick for Publishers, or DFP)<sup>727</sup> and an ad exchange (DoubleClick Ad Exchange),<sup>728</sup> as well as other ad tech tools—introduced an innovation called Dynamic Allocation (DA).<sup>729</sup>

227. Dynamic Allocation worked as follows: For each demand source in the waterfall in DFP (at that time usually ad networks), a publisher would set a “value CPM.”<sup>730</sup> While Professor Gans states that “[i]n the Waterfall process, demand partners were ranked sequentially based on their average historical yield rather than based on the impression value,”<sup>731</sup> at the time that the waterfall was introduced, the value CPM for a given ad network was often based on a static price

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<sup>727</sup> “DART for Publishers,” *DoubleClick*, October 1, 2007, available at <https://web.archive.org/web/20071001100536/http://www.doubleclick.com/products/dfp/index.aspx> (“DoubleClick’s DART for Publishers solution keeps you ahead of the pack by providing the scalability, reliability, and the critical tools to accelerate your digital ad operation. DART for Publishers (DFP) is a comprehensive hosted ad serving platform that streamlines your ad management functions and allows you to generate ever-greater advertising margins.”); ABM, “DoubleClick for Publishers (DFP) To Maximize Revenue: Know All About It,” *AndBeyond Media*, December 16, 2022, available at <https://www.andbeyond.media/blogs/doubleclick-for-publishers-to-maximize-revenue/> (“It started in 2007 with the DoubleClick Company, comprising the DART for Publishers ad server and the DoubleClick Ad Exchange. DART was later rebranded as DoubleClick for Publishers in 2010.”).

<sup>728</sup> Louise Story, “DoubleClick to Set Up an Exchange for Buying and Selling Digital Ads,” *The New York Times*, April 4, 2007, available at <https://www.nytimes.com/2007/04/04/business/media/04adco.html> (“The service will let advertisers see information about what competitors bid for particular ads, in the same way that eBay shows visitors past bids. And it will let publishers try to ensure that they sell their ad spots at the highest possible price, the way that airlines try to do with the seats they sell.”); “DoubleClick Advertising Exchange,” *DoubleClick*, October 1, 2007, available at <https://web.archive.org/web/20071001100309/http://www.doubleclick.com/products/advertisingexchange/index.aspx> (“DoubleClick’s proprietary Dynamic Allocation system sells inventory through the channel that pays the highest price, in real time. Collection risk is eliminated with DoubleClick’s clearing system.”).

<sup>729</sup> GOOG-DOJ-AT-01133273 at 277 (a document dated March 29, 2007, explaining “[k]ey features of DoubleClick Advertising Exchange, which include, among others, “Dynamic allocation for sellers. DoubleClick Advertising Exchange automatically determines how to generate the highest return for every impression by dynamically allocating to the highest paying sales channel.”).

<sup>730</sup> “Line items: Value CPM,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/177222?hl=en> (“The value CPM (cost per thousand impressions) is an amount you specify to help Google Ad Manager estimate the value of campaigns.”).

<sup>731</sup> Gans Report, ¶ 107.

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the ad network had agreed to pay if it purchased the impression. Dynamic Allocation would then use the highest value CPM in DFP as a *floor price* for buyers in the DoubleClick Ad Exchange auction.<sup>732</sup> If the highest bidder in the auction on the DoubleClick Ad Exchange offered to pay a price higher than that floor price (net of fees), then the ad associated with that highest bidder would serve.<sup>733</sup> If no buyer on the DoubleClick Ad Exchange submitted a bid higher than the floor price (net of fees), then the publisher would run through the waterfall process to see if a demand source in the waterfall would buy the ad.<sup>734</sup> Notably, the bidders on the DoubleClick Ad Exchange could include the same ad networks that a publisher could call through the waterfall process, but on the DoubleClick Ad Exchange, those ad networks could bid against each other in an auction to buy an impression, rather than being called one at a time through the sequential waterfall.<sup>735</sup>

228. Dynamic Allocation provided a significant improvement over static pricing in the waterfall: publishers gained the opportunity to obtain a higher price (CPM) *if* one was available from bidders on the DoubleClick Ad Exchange, while retaining the ability to sell inventory through other demand sources in the waterfall when bidders on the DoubleClick Ad Exchange did not supply the highest price.<sup>736</sup> Professor Gans also acknowledges that Dynamic Allocation

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<sup>732</sup> GOOG-TEX-00077719 at 720-721 (“Non-guaranteed ads [...] typically sell at a lower price because of the potential that another buyer will pay a higher price after the initial sale, before the impression is actually delivered; hence the ‘non-guaranteed’ status. With indirect sales, the CPM is usually fixed, but the number of impressions delivered is not. [...] Dynamic allocation passes to the Ad Exchange the CPM value associated with the ad that the primary ad server has selected and is about to serve. The technology then uses this CPM value as the minimum CPM for the auction. If the Ad Exchange can provide the publisher with a net CPM value higher than they would have gotten from delivering their directly booked, non-guaranteed ad, the Ad Exchange will deliver an ad. If, however, the directly booked ad’s CPM value is higher, it ignores any bids coming in from the Ad Exchange.”).

<sup>733</sup> GOOG-TEX-00077719 at 721 (“If the Ad Exchange can provide the publisher with a net CPM value higher than they would have gotten from delivering their directly booked, non-guaranteed ad, the Ad Exchange will deliver an ad.”).

<sup>734</sup> GOOG-TEX-00077719 at 721 (“If, however, the directly booked ad’s CPM value is higher, [Dynamic Allocation] ignores any bids coming in from the Ad Exchange.”).

<sup>735</sup> “DoubleClick Advertising Exchange,” *DoubleClick*, October 1, 2007, available at <https://web.archive.org/web/20071001100309/http://www.doubleclick.com/products/advertisingexchange/index.aspx> (“Through an impression-by-impression auction marketplace, the [DoubleClick Ad Exchange] connects industry-leading online publishers with top-tier advertisers, agencies and networks. [...] DoubleClick’s proprietary Dynamic Allocation system sells inventory through the channel that pays the highest price, in real time.”).

<sup>736</sup> GOOG-AT-MDL-008842393 at 396; GOOG-TEX-00077719 at 722 (“In a recent study (Q1, 2010), we compared the average effective CPM from the Ad Exchange with aggregate directly booked inventory sold



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“represented an improvement over previous sequential processes by which the ad server called ad networks which did not bid in real time known as the Waterfall.”<sup>737</sup>

229. Just before DoubleClick released Dynamic Allocation, Google, Microsoft, Yahoo, and AOL all competed to try to acquire the company.<sup>738</sup> Outbidding Microsoft and the other potential buyers, in April 2007, Google agreed to acquire DoubleClick for \$3.1 billion. The Federal Trade Commission decided, in late 2007, not to seek to block the acquisition.<sup>739</sup> Google officially closed the deal in early 2008, after also receiving unconditional antitrust approval from the European Commission.<sup>740</sup> As the timeline above suggests, DoubleClick developed and introduced Dynamic Allocation *before* it was acquired by Google.<sup>741</sup>

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through in DFP. The results of our research demonstrated that the combined effects of auction pressure and Dynamic Allocation in DoubleClick Ad Exchange resulted in an average CPM lift of [REDACTED] compared with fixed, upfront, pre-negotiated sales of non-guaranteed inventory.”); “Benefits for Sellers,” *DoubleClick*, October 11, 2007, available at [https://web.archive.org/web/20071011001851/http://www.doubleclick.com/products/advertisingexchange/benefits\\_for\\_sellers.aspx](https://web.archive.org/web/20071011001851/http://www.doubleclick.com/products/advertisingexchange/benefits_for_sellers.aspx) (“Proprietary Dynamic Allocation System[:] The service automatically generates the highest return for every impression by dynamically allocating to the sales channel – your direct sales channel (through DFP / DE) or through DoubleClick Advertising Exchange – that pays the most.”).

<sup>737</sup> Gans Report, ¶ 547.

<sup>738</sup> Louise Story, and Miguel Helft, “Google Buys DoubleClick for \$3.1 Billion,” *The New York Times*, April 14, 2007, available at <https://www.nytimes.com/2007/04/14/technology/14DoubleClick.html> (“The sale brings to an end weeks of a bidding battle between Microsoft and Google.”); Elinor Mills, “Google buys ad firm DoubleClick for \$3.1 billion,” *CNET*, April 13, 2007, available at <https://www.cnet.com/tech/tech-industry/google-buys-ad-firm-doubleclick-for-3-1-billion/> (“The announcement puts to rest rumors reported by *The Wall Street Journal* of a heated bidding war over DoubleClick between Google, Microsoft and even Yahoo and AOL.”).

<sup>739</sup> Federal Trade Commission, “Federal Trade Commission Closes Google/DoubleClick Investigation,” *Federal Trade Commission*, December 20, 2007, available at <https://www.ftc.gov/news-events/news/press-releases/2007/12/federal-trade-commission-closes-googledoubleclick-investigation>.

<sup>740</sup> Reuters, “EU Approves Google’s Buy of DoubleClick,” *CNBC*, March 11, 2008, available at <https://www.cnbc.com/2008/03/11/eu-approves-googles-buy-of-doubleclick.html>; “Google Closes Acquisition of DoubleClick,” *Google*, March 11, 2008, available at [https://googlepress.blogspot.com/2008/03/google-closes-acquisition-of\\_11.html](https://googlepress.blogspot.com/2008/03/google-closes-acquisition-of_11.html).

<sup>741</sup> This fact is also acknowledged by Plaintiffs’ experts. *See, e.g.*, Gans Report, ¶ 552 (“DoubleClick launched its ad exchange in 2007 before Google acquired it in 2008. Along with the exchange, DoubleClick also launched a feature called Dynamic Allocation.”); Weinberg Report, Footnote 110 (also included in the Chandler Report, Appendix D). Google later launched an updated version of Dynamic Allocation, called Enhanced Dynamic Allocation (or EDA), in March 2014. *See* GOOG-AT-MDL-008842393 at 399. EDA allowed AdX (and other demand sources in DFP) to compete against guaranteed reservation line items for the first time, but did not substantially change how the waterfall interacted with AdX bids. *See* GOOG-DOJ-AT-02096796 at 796 (“Enhanced Dynamic Allocation introduce[d] competition between guaranteed reservations and other demand including AdX and DFP remnant reservations[.]”).

230. Around the same time that Google acquired DoubleClick, Microsoft acquired AdECN, and Yahoo acquired Right Media, two other major ad exchanges at the time.<sup>742</sup>

**F. Around 2007, supply-side platforms began to emerge to help publishers more efficiently manage ad network sales.**

231. Like DoubleClick, others in the industry were also working to improve publisher yield. As depicted in **Figure 25**, supply-side platforms (SSPs, also known as “yield managers”)<sup>743</sup> emerged around 2007 to help publishers manage relationships with multiple ad networks through a single interface<sup>744</sup> by automating the optimization of their waterfall setups to generate higher revenues.<sup>745</sup>

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<sup>742</sup> “Microsoft to Acquire AdECN, Inc.,” *Microsoft*, July 26, 2007, available at <https://news.microsoft.com/2007/07/26/microsoft-to-acquire-ade-cn-inc/>; Eric Auchard, “Yahoo to buy rest of Right Media for \$680 mln,” *Reuters*, August 9, 2007, available at <https://www.reuters.com/article/us-rightmedia-yahoo/yahoo-to-buy-rest-of-right-media-for-680-mln-idUSN3037037520070430>.

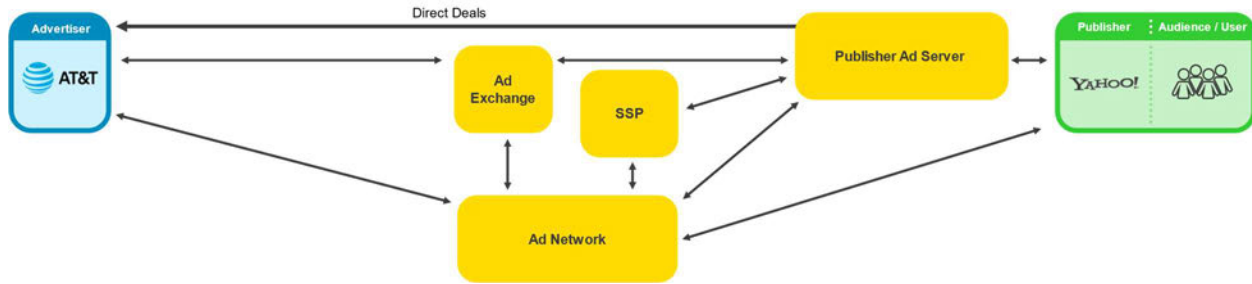
<sup>743</sup> Gotham Ads, “The Evolution of SSPs: From Ad Servers to Programmatic Powerhouses,” *LinkedIn*, October 11, 2023, available at <https://www.linkedin.com/pulse/evolution-ssps-from-ad-servers-programmatic-powerhouses-gothamads> (“In the early stages, even though SSPs had automated pricing algorithms in place, they maintained dedicated yield management teams. These teams manually adjusted various network tags based on historical performance, with a focus on individual publishers.”); Irina Kovalenko, “RTB Programmatic: Media Buying and Real-Time Bidding,” *SmartyAds*, April 12, 2017, available at <https://smartyads.com/blog/stop-confusing-programmatic-with-real-time-bidding/> (“SSP (supply-side platform): A platform to help publishers to manage and price their ad inventory that is also referred to as yield managers and optimizers”).

<sup>744</sup> “The Evolution Of The Supply Side Platform,” *Sharethrough*, December 14, 2015, available at <https://www.sharethrough.com/blog/the-evolution-of-the-supply-side-platform> (“With the entrance of Admeld, Rubicon Project and PubMatic, publishers could maximize their remnant revenue by working with multiple ad networks at once without having to manually optimize each network’s performance — the SSPs would do it for them.”); Erick Schonfeld, “Rubicon Project Launches: A Network of Ad Networks,” *TechCrunch*, October 8, 2007, available at <https://techcrunch.com/2007/10/08/rubicon-project-launches-a-network-of-ad-networks/> (“[The Rubicon Project] provides one dashboard to manage all of a company’s ad campaigns, and tries to optimize across ad networks—from Google, Yahoo, and Tacoda (AOL) to AdBrite to HispanoClick—to deliver the most bang for the buck.”); Rafe Needleman, “PubMatic gets ad networks to fight for you,” *CNET*, September 18, 2007, available at <https://www.cnet.com/tech/services-and-software/pubmatic-gets-ad-networks-to-fight-for-you/> (“Run a Web site or blog and don’t know which of the several advertising networks to use? [...] PubMatic has an [...] idea: Get competing ad networks (Google, Yahoo, ValueClick, Komli, and BlueLithium for now; more to come) to bid for your site’s eyeballs. PubMatic has a clever model that brokers your site’s traffic to the various networks, and swaps out their ad modules depending on which one pays better.”).

<sup>745</sup> Irina Kovalenko, “What is a Supply-Side Platform (SSP) and How Does It Work,” *SmartyAds*, November 5, 2020, available at <https://smartyads.com/blog/meet-ssp-the-very-best-friend-of-a-digital-publisher/> (“[SSPs] automate ad inventory filling, match publisher’s requirements with demand, perform ad selection, and yield optimization. [...] [P]ublishers configure the ad serving process in the dashboard of SSPs. Why do you need SSP as a publisher? Both publishers and advertisers are turning less to traditional media-trading. The media buying process has become fully automated, which saves time and reduces the internet advertising budget.”);

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**Figure 25. Supply-Side Platforms Help Publishers Optimize Yield**



**Notes:**

[1] This figure is reproduced as **Figure D-5** in **Appendix D**.

232. Automation provided by supply-side platforms (SSPs) enabled publishers to interact with a larger number of ad networks, which increased the chances that each ad impression would be matched to the best ad.<sup>746</sup> Admeld, Rubicon Project, PubMatic, AppNexus, and OpenX were some of the first SSPs to emerge during this time period.<sup>747</sup>

"The Evolution Of The Supply Side Platform," *Sharethrough*, December 14, 2015, available at <https://www.sharethrough.com/blog/the-evolution-of-the-supply-side-platform> ("[P]ublishers could maximize their remnant revenue by working with multiple ad networks at once without having to manually optimize each network's performance — the SSPs would do it for them.").

<sup>746</sup> "Interview with Frank Addante, Rubicon Project," *socalTECH*, October 8, 2007, available at [https://socaltech.com/interview\\_with\\_frank\\_addante\\_rubicon\\_project/s-0011613.html](https://socaltech.com/interview_with_frank_addante_rubicon_project/s-0011613.html).

<sup>747</sup> "Supply Side Platforms (SSPs)," *Treasure Data*, available at <https://www.treasuredata.com/glossary/supply-side-platform-ssp/>. For example, Admeld provided an interface that allowed publishers to offer their inventory for sale to the highest bidder among multiple networks and exchanges in real time. See "Overview," *Admeld Publishers*, August 21, 2008, available at <https://web.archive.org/web/20080821051555/http://www.admeld.com/publishers.html>. Google acquired Admeld in 2011. See "The best of Admeld, now in DoubleClick Ad Exchange." *Google Admeld*, available at <https://www.admeld.com/> ("Google bought Admeld in 2011 and we've worked diligently to build Admeld's best features into the DoubleClick Ad Exchange.").

Similarly, Rubicon Project provided a single dashboard that would optimize across ad networks. See Erick Schonfeld, "Rubicon Project Launches: A Network of Ad Networks," *TechCrunch*, October 8, 2007, available at <https://techcrunch.com/2007/10/08/rubicon-project-launches-a-network-of-ad-networks/>. Rubicon Project merged with Telaria in 2020 to form Magnite. See Sarah Sluis, "Meet Magnite, The Post-Merger Name For Rubicon Project And Telaria," *AdExchanger*, June 30, 2020, available at <https://www.adexchanger.com/platforms/meet-magnite-the-post-merger-name-for-rubicon-project-and-telaria/>.

PubMatic initially offered publishers a choice between Google, Yahoo, ValueClick, Komli, and BlueLithium ad networks, with more ad networks added to their self-serve solution later on. See Rafe Needleman, "PubMatic gets ad networks to fight for you," *CNET*, September 18, 2007, available at <https://www.cnet.com/tech/services-and-software/pubmatic-gets-ad-networks-to-fight-for-you/> ("PubMatic [...] gets] competing ad networks (Google, Yahoo, ValueClick, Komli, and BlueLithium for now; more to come) to bid for your site's eyeballs. [...] The service also continuously modifies the layout of ad modules and tries to lock in the ones that work best for your site.").

233. In June 2011, Google added yield management functionality to its sell-side offering by acquiring Admeld,<sup>748</sup> an SSP that offered publishers waterfall optimization.<sup>749</sup> In December 2011, the Department of Justice announced that it would not challenge the transaction.<sup>750</sup>

**G. In the late 2000s, real-time bidding emerged to enable bidding based on real-time information on ad exchanges.**

234. As discussed in **Section VII.D**, because buyers at the time could only bid into ad exchanges based on pre-set bids, the clearing price for a transaction did not reflect the advertiser's actual value of each individual impression based on the specific combination of the website and the individual user's characteristics.<sup>751</sup>

235. Moreover, even with the advent of ad exchanges, the waterfall system remained in place. Publishers would rank selected ad exchanges alongside selected ad networks in the waterfall, and publishers would call those demand sources in a pre-set sequential order until the sale completed. That process potentially left money on the table if an impression was sold to the *first* ad exchange or ad network with a buyer willing to buy, while there was another ad exchange or ad network ranked lower in the waterfall with a buyer willing to pay a higher price for the impression.<sup>752</sup>

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<sup>748</sup> Michael Arrington, "Google Acquires AdMeld For \$400 Million," *TechCrunch*, June 9, 2011, available at <https://techcrunch.com/2011/06/09/google-acquires-admeld-for-400-million>.

<sup>749</sup> "Statement of the Department of Justice's Antitrust Division on Its Decision to Close Its Investigation of Google Inc.'s Acquisition of Admeld Inc." *U.S. Department of Justice*, December 2, 2011, available at <https://www.justice.gov/opa/pr/statement-department-justices-antitrust-division-its-decision-close-its-investigation-google> ("Admeld operates a supply-side platform (SSP) that helps publishers optimize the yield from their display advertising inventory."). AdMeld also offered real-time bidding functionality. See **Section VII.H** regarding real-time bidding and SSPs.

<sup>750</sup> "Statement of the Department of Justice's Antitrust Division on Its Decision to Close Its Investigation of Google Inc.'s Acquisition of Admeld Inc." *U.S. Department of Justice*, December 2, 2011, available at <https://www.justice.gov/opa/pr/statement-department-justices-antitrust-division-its-decision-close-its-investigation-google>.

<sup>751</sup> "The Power of Real-Time Decisioning in the Online Advertising Marketplace," *DataXu Insights*, September 14, 2009, available at [https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu\\_wp\\_091409.pdf](https://web.archive.org/web/20100601182955/http://www.dataxu.com/documents/dataxu_wp_091409.pdf); "Real-Time Bidding," *DataXu*, September 22, 2009, available at <https://web.archive.org/web/20090922214534/http://www.dataxu.com/bidding.php>.

<sup>752</sup> Maciej Zawadziński, and Mike Sweeney, "Waterfalling, Header Bidding and New Auction Dynamics," *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/sequential-auctions-header-bidding-first->

236. In the late 2000s, ad exchanges and SSPs began to develop and offer *real-time bidding* for buyers (often referred to as RTB), a new technology that enabled ad buyers to bid for ad impressions in real time based on information about the actual users to whom the ads would be shown.<sup>753</sup> In November 2010, certain industry participants launched the OpenRTB Consortium to develop standard industry protocols to facilitate real-time bidding, including the OpenRTB 2.0, which was announced in June 2011 and officially adopted as an IAB standard in January 2012.<sup>754</sup> Industry studies found that real-time bidding benefitted both publishers and advertisers when compared to the previous system, where buyers would pre-set the prices they would offer

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price-second-price-auctions/ (“In waterfalling, each new impression is first processed in the publisher’s ad server with the aim of matching it to their direct campaigns. Then, if no eligible direct campaign is found, the impression is sent to the next partner in line, typically an ad network or SSP, which tries to fill the impression. [...] The order of the waterfall is typically based on average historical yield, which is the average amount of money the demand source has made for the publisher in the past. Once an impression is filled, all the other demand sources in the waterfall are not queried, meaning all the other (possibly higher) bids are never considered.”); Maciej Zawadziński, and Mike Sweeney, “What is Waterfalling and How Does it Work?” *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/what-is-waterfalling/> (“Traditionally, publishers applied the waterfalling process to ad networks, but publishers soon realized they could apply it to supply-side platforms (SSPs) as well. However, many are questioning why publishers are doing this, as it essentially means demand sources (e.g. ad exchanges connected via SSPs) could be bidding on the same impression multiple times as the impressions go along the daisy chain. [...] [T]he publisher’s ad server chooses the demand sources based on the highest average yield, not the current market price of inventory, meaning the price given is the average CPM, not the true CPM. You can predict based on historical data what the CPM on a given ad network will be — or even negotiate the floor price — but you’re never sure what the final price could actually be.”).

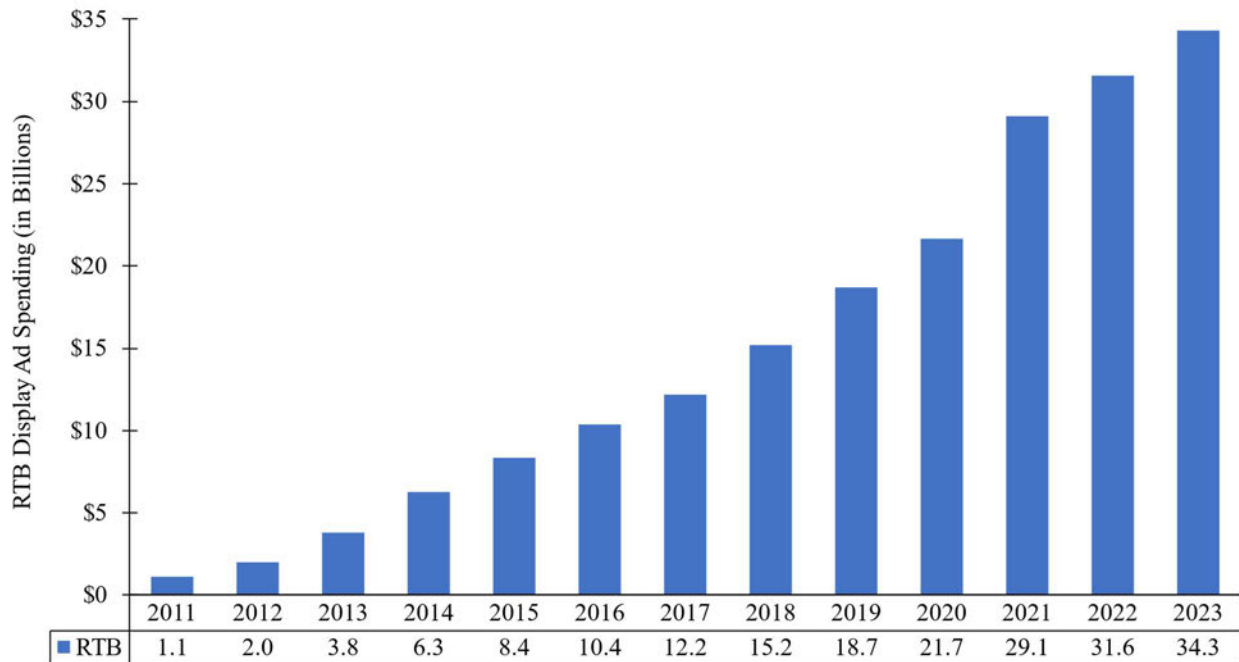
<sup>753</sup> John Ebbert, “Define It – What Is Real-Time Bidding?” *AdExchanger*, November 27, 2012, available at <https://www.adexchanger.com/online-advertising/real-time-bidding/> (“Real time bidding [...] A Technology introduced in 2009 [...] The act of buying digital inventory from multiple publishers on an impression by impression basis, typically involving an auction pricing mechanism [...] Real-Time Bidding means that every online ad impression can be evaluated, bought, and sold, all individually, and all instantaneously. It is the future of all online advertising and enables exchanges and buyers to work together to programmatically sell and place bids on ads. It allows every impression to be cost effective, and to be placed in front of the right person, at the right time.”); Gotham Ads, “The Evolution of SSPs: From Ad Servers to Programmatic Powerhouses,” *LinkedIn*, October 11, 2023, available at <https://www.linkedin.com/pulse/evolution-ssps-from-ad-servers-programmatic-powerhouses-gothamads> (“In 2009, major SSPs began supporting Real-Time Bidding (RTB), which allowed buyers to purchase ad inventory on an individual impression level, significantly improving efficiency and campaign performance across multiple exchanges.”).

<sup>754</sup> “Real Time Bidding (RTB) Project: OpenRTB API Specification Version 2.5,” *IAB*, December 2016, available at <https://www.iab.com/wp-content/uploads/2016/03/OpenRTB-API-Specification-Version-2-5-FINAL.pdf>.

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for future impressions based on certain targeting information.<sup>755, 756</sup> These benefits spurred the rapid growth of ad spending via real-time bidding over time, as depicted in **Figure 26**.

**Figure 26. Real-Time Bidding Display Ad Spending in the U.S., 2011-2023**



**Notes:**

[1] According to eMarketer, real-time bidding (RTB) display ads are programmatic display ads that are transacted in real time, at the impression level. The ad spending presented above includes: 1) advertising that appears on desktop/laptop computers, mobile phones, tablets, and other internet-connected devices; and 2) native ads and ads on social networks like Facebook and X.

**Source:** eMarketer data produced as GOOG-AT-MDL-DATA-000597223.

237. As real-time bidding grew in prominence, ad exchanges typically employed a second-price auction in which the buyer with the highest bid that exceeded the price floor won the

<sup>755</sup> R. Preston McAfee, “The Design of Advertising Exchanges,” *Review of Industrial Organization*, Vol. 39, No. 3, 2011, pp. 169-185 at p. 171 (“Advertisers can place bids for the types of target opportunities that they seek, and whoever values the opportunity the most will win. Certainly real-time auctions maximize the potential advertiser value and will tend to be more efficient than other transaction mechanisms.”); “Real-Time Bidding: The Ad Exchange Leaps,” *AdExchanger*, May 5, 2009, available at <https://www.adexchanger.com/ad-exchange-news/real-time-bidding-rtb-display-ad-exchange/> (“Advertisers will be more willing to buy media – and bid higher for media (making happy publishers) – that they believe will likely perform well given the efficiencies created through RTB. Proprietary data from advertisers can be mapped against any potential media buying campaign to further improve performance.”).

<sup>756</sup> For example, an RTB case study conducted by PubMatic, MediaMath, [x+1], Turn, and DataXu found that RTB increased publisher revenue by 64% on average (compared to non-RTB campaigns) and improved advertiser



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auction and that winning bidder paid the price offered by the second-highest bidder plus \$0.01. If the winner was the only bidder above the floor, then the winner would pay the publisher-set floor price plus \$0.01.<sup>757</sup>

238. A number of ad exchanges began to allow advertisers to submit real-time bids in 2009 and 2010, including OpenX's OpenX Market,<sup>758</sup> Yahoo's Right Media exchange,<sup>759</sup> Microsoft's AdECN,<sup>760</sup> and Google's AdX (the relaunched DoubleClick Ad Exchange).<sup>761</sup>

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performance by 749% on average (compared to non-RTB media buying methods). See "Collaborative Case Study by PubMatic, DataXu, MediaMath, Turn, and [x+1] Reveals Significant Benefits of Real-Time Bidding for Publishers and Advertisers," *Ad Tech Daily*, October 13, 2010, available at <https://adtechdaily.com/2010/10/13/collaborative-case-study-by-pubmatic-dataxu-mediamaath-turn-and-x1-reveals-significant-benefits-of-real-time-bidding-for-publishers-and-advertisers/>.

During April and May 2011, AdX RTB campaigns had 19% lower CPM rates than non-RTB campaigns on AdX and raised CTR performance from 0.09% to 0.15%. See "The Arrival of Real-Time Bidding and What it Means for Media Buyers," *Google*, July 2011, available at <https://www.rtbchina.com/wp-content/uploads/2012/03/Google-White-Paper-The-Arrival-of-Real-Time-Bidding-July-2011.pdf>, at p. 6.

Google also found that the average revenue for publishers from ad slots sold through DoubleClick Ad Exchange—"a real-time auction marketplace for display ad space"—was 130% higher than the average revenue from ad slots sold through non-RTB remnant channels such as ad networks and other third parties. See Neal Mohan, "Our approach to maximizing advertising revenue for online publishers," *Google Official Blog*, February 9, 2010, available at <https://googleblog.blogspot.com/2010/02/our-approach-to-maximizing-advertising.html>.

<sup>757</sup> Maciej Zawadziński, and Mike Sweeney, "Waterfalling, Header Bidding and New Auction Dynamics," *Clearcode*, February 5, 2024, available at <https://clearcode.cc/blog/sequential-auctions-header-bidding-first-price-second-price-auctions/>; Alise Zaiceva, "First-Price vs Second-Price Auction | Differences Explained," *Setupad Blog*, April 22, 2021, available at <https://setupad.com/blog/first-price-vs-second-price-auction/>.

<sup>758</sup> Leena Rao, "OpenX Market Opens For Business As An Alternative Online Advertising Marketplace," *TechCrunch*, April 16, 2009, available at <https://techcrunch.com/2009/04/16/openx-market-opens-for-business-as-an-alternative-online-advertising-marketplace/>.

<sup>759</sup> Stephanie Clifford, "Instant Ads Set the Pace on the Web," *The New York Times*, March 11, 2010, available at <https://www.nytimes.com/2010/03/12/business/media/12adco.html> ("Now, companies like Google, Yahoo and Microsoft let advertisers buy ads in the milliseconds between the time someone enters a site's Web address and the moment the page appears. The technology, called real-time bidding, allows advertisers to examine site visitors one by one and bid to serve them ads almost instantly."). Right Media was shut down in 2015. See Allison Schiff, "Yahoo Finally Pulls The Plug On Right Media Exchange," *AdExchanger*, January 9, 2015, available at <https://www.adexchanger.com/platforms/yahoo-finally-pulls-the-plug-on-right-media-exchange/>.

<sup>760</sup> Stephanie Clifford, "Instant Ads Set the Pace on the Web," *The New York Times*, March 11, 2010, available at <https://www.nytimes.com/2010/03/12/business/media/12adco.html> ("Now, companies like Google, Yahoo and Microsoft let advertisers buy ads in the milliseconds between the time someone enters a site's Web address and the moment the page appears. The technology, called real-time bidding, allows advertisers to examine site visitors one by one and bid to serve them ads almost instantly."). AdECN was shut down in 2010. See "Report: (Correction) Microsoft Shuts Down AdECN 'Hosted System,'" *AdExchanger*, January 11, 2010, available at <https://www.adexchanger.com/ad-exchange-news/report-ade-cn-shuts-down-hosted-system/>.

<sup>761</sup> Alise Zaiceva, "Google AdX vs Google AdSense | Differences Explained," *Setupad Blog*, December 16, 2021, available at <https://setupad.com/blog/adsense-vs-ad-exchange/>; GOOG-DOJ-06570825 at 825 ("The Ad Exchange is an open marketplace where display advertising space is bought and sold in real time between

239. Although real-time bidding exchanges and SSPs became popular over time, publishers continued to use the waterfall method as well.<sup>762</sup>

240. Since 2018, Google has offered ad exchange functionality within Google Ad Manager. That functionality was formerly offered as AdX—and before that as DoubleClick Ad Exchange.

241. The introduction of real-time bidding sparked the growth of *programmatic advertising*, which involves the use of automated technologies to match buyers and sellers of digital advertising inventory.<sup>763</sup> Programmatic advertising includes forms of both direct and indirect transactions (*see Section VII.L* for discussions of programmatic direct deals).<sup>764</sup> Programmatic advertising streamlined the process of display ad sales by reducing the level of human involvement that is required in ad selling and buying, and real-time bidding enabled buyers to better assess the value of an individual impression for a particular advertiser in real time.<sup>765</sup> This occurred not only on ad exchanges and SSPs, but also on self-service platforms offered by social media companies and retailers, as described in **Section III.B** above.

242. **Figure 27** illustrates the rapid growth of programmatic advertising (measured in terms of the total ad spending in the U.S.).

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advertising networks and major online publishers.”), 827 (“The Ad Exchange has a new real-time bidder feature that allows buyers to use their own data, optimization and ad serving technologies to bid on their desired inventory on an impression-by-impression basis, choosing only the sites, audiences, or particular type of ad space they want to reach.”).

<sup>762</sup> Hana Choi, Carl F. Mela, Santiago R. Balseiro, and Adam Leary, “Online Display Advertising Markets: A Literature Review and Future Directions,” *Information Systems Research*, Vol. 31, No. 2, 2020, pp. 556-575 at p. 567, Footnote 39.

<sup>763</sup> Mike Sweeney, “What is Programmatic Advertising? The Definitive Guide for 2024,” *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/programmatic-advertising/>.

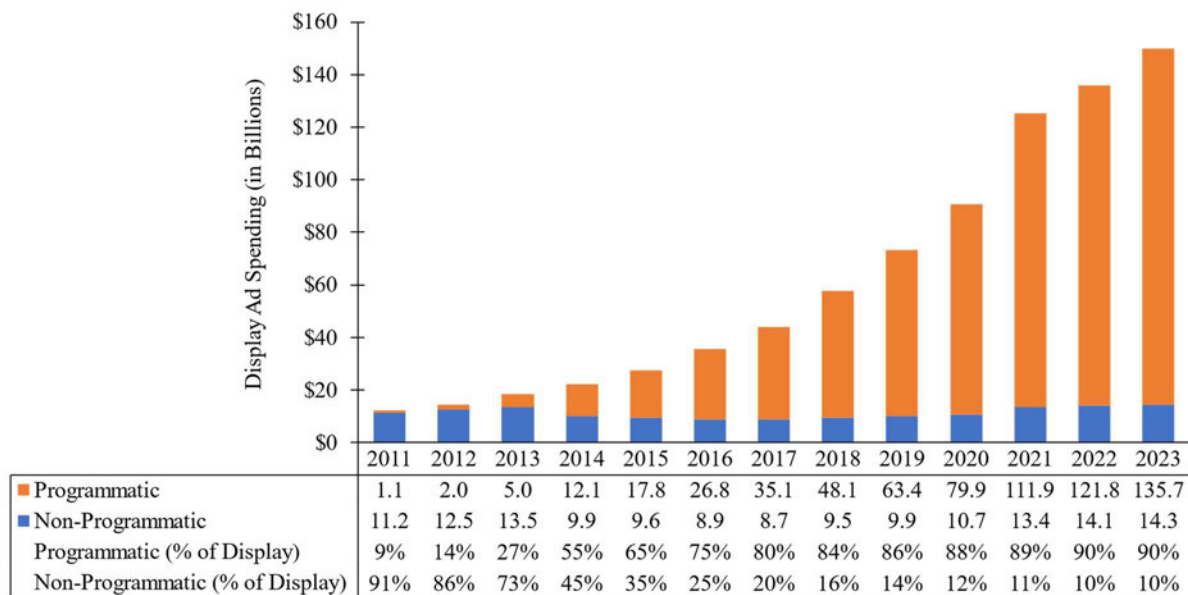
<sup>764</sup> While focusing on “programmatic auctions” in his Opinion No. 4 (*see* Chandler Report, ¶ 95), Dr. Chandler also acknowledges the use of both direct and indirect transactions in programmatic advertising. *See* Chandler Report, ¶¶ 107, 113.

<sup>765</sup> Mike Sweeney, “What is Programmatic Advertising? The Definitive Guide for 2024,” *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/programmatic-advertising/>; Naomi Khor, “What Is Programmatic Advertising? How Does It Work?” *Publift*, June 28, 2024, available at <https://www.publift.com/adteach/what-is-programmatic-advertising>.



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**Figure 27. Programmatic and Non-Programmatic Display Ad Spending in the U.S., 2011-2023**



**Notes:**

[1] According to eMarketer, programmatic display ads are display ads transacted or fulfilled via automation (including everything from publisher-erected APIs to more standardized RTB technology). The ad spending presented above includes: 1) advertising that appears on desktop/laptop computers, mobile phones, tablets, and other internet-connected devices; and 2) native ads and ads on social networks like Facebook and X.

[2] eMarketer does not report non-programmatic display ad spending. It is calculated as follows: non-programmatic display ad spending = (programmatic display ad spending) / (programmatic display ad spending as a percentage of total display ad spending) × (1 – programmatic display ad spending as a percentage of total display ad spending).

**Sources:** eMarketer data produced as GOOG-AT-MDL-DATA-000597221.

## H. Real-time bidding led to further development of publisher- and advertiser-facing tools.

### 1. Supply-side platforms developed real-time bidding functionality.

243. When real-time bidding was first introduced, publishers made their inventory available on ad exchanges in real time, but they had little control over which ads were being shown on

their websites, or how the data they provided to ad exchanges was being used.<sup>766</sup> In response, SSPs—previously developed to optimize publishers’ waterfall setup for ad networks (see **Section VII.F**)—innovated to fill the need.<sup>767</sup> Various SSPs developed real-time bidding marketplaces of their own to provide publishers with better brand controls and data protections than ad exchanges were offering at the time. For example, PubMatic and the Rubicon Project developed their own real-time bidding marketplaces by 2010.<sup>768</sup>

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<sup>766</sup> This lack of control led to issues related to brand control and data safety. See “Understanding Real-Time Bidding (RTB) From the Publisher Perspective,” *PubMatic*, February 2010, available at [https://web.archive.org/web/20100331183016/http://www.pubmatic.com/wp-content/uploads/2010/02/PubMatic\\_RT\\_B\\_White\\_Paper.pdf](https://web.archive.org/web/20100331183016/http://www.pubmatic.com/wp-content/uploads/2010/02/PubMatic_RT_B_White_Paper.pdf), at pp. 28-30 (“RTB is not without its own brand control and data safety risks. [...] The publisher owns their own data and publishers need the ability to set rules around which data they pass to a specific bidder. [...] Publishers should have a way of protecting themselves from data theft. [...] A publisher’s sell side platform partner should have a creative screening of all advertiser creative on the publisher’s site available to view in real-time.”); “Market Trends & Challenges,” *Rubicon Project*, August 28, 2010, available at [https://web.archive.org/web/20100828203946/http://www.rubiconproject.com/for\\_publishers/market-trends-challenges](https://web.archive.org/web/20100828203946/http://www.rubiconproject.com/for_publishers/market-trends-challenges) (“To get full access to all of the money in the market, publishers need to connect to hundreds of different sales channels (ad networks, exchanges, etc.) since 2/3 of inventory is sold on a non-guaranteed basis. They need to integrate with data providers and exchanges to sell by audience (which is how advertisers want to buy today). They need to deploy security technology to protect their ad stream, both direct- and indirect-sold, their site(s) and their users.”).

<sup>767</sup> Naomi Khor, “What is a Supply-Side Platform?” *Publift*, June 28, 2024, available at <https://www.publift.com/adteach/what-is-a-supply-side-platform> (“Inventory and campaign management – allows publishers to manage different types of ad inventory and block certain types of ads.”); Michal Wlosik, and Maciej Zawadzinski, “What Is a Supply-Side Platform (SSP) and How Does It Work?” *Clearcode*, January 31, 2024, available at <https://clearcode.cc/blog/what-is-supply-side-platform/> (“By building a custom SSP, publishers can gain control of not only the technology, but also the data. This is particularly beneficial for companies that have run multiple websites.”); Anete Jodzevica, “Top SSPs for Publishers for 2024,” *Setupad Blog*, November 24, 2023, available at <https://setupad.com/blog/top-ssps-for-publishers/> (“Selecting the right SSP for publishers means carefully evaluating their needs and goals. Publishers should consider factors such as the SSP’s integration capabilities with their existing technology stack, the quality and variety of demand sources the SSP can access, and the level of transparency and control over ad inventory and user data.”).

<sup>768</sup> “Understanding Real-Time Bidding (RTB) From the Publisher Perspective,” *PubMatic*, February 2010, available at [https://web.archive.org/web/20100331183016/http://www.pubmatic.com/wp-content/uploads/2010/02/PubMatic\\_RT\\_B\\_White\\_Paper.pdf](https://web.archive.org/web/20100331183016/http://www.pubmatic.com/wp-content/uploads/2010/02/PubMatic_RT_B_White_Paper.pdf), at p. 21 (“An RTB bid only wins if it beats the pricing coming from PubMatic’s Ad Price Prediction™ and direct sold insertion orders that a publisher’s direct sales team entered into PubMatic’s system.”); “the Rubicon Project Opens Doors To REVV for demand™,” *Rubicon Project*, April 20, 2010, available at <https://web.archive.org/web/20100727042644/http://rubiconproject.com/about/press/the-rubicon-project-opens-doors-to-revv-for-demand-to-provide-safe-fair-acc/> (“To ensure safe and high quality inventory, all inventory available through REVV for demand [the technology platform powering REVV Marketplace, Rubicon’s RTB marketplace] is Rubicon Certified, and verified through AdSafe Media’s proprietary content analysis technology. [...] ‘Our priority is to provide our premium Web publisher customers with complete control and visibility to ensure they sell every ad impression through the best channel – for the right price,’ said Craig Roah, COO and Founder of the Rubicon Project.”).

244. Over time, SSPs such as PubMatic and Rubicon shifted their focus to real-time bidding and away from network waterfall optimization.<sup>769</sup> As a result, the services offered by SSPs with real-time bidding marketplaces became virtually indistinguishable from services offered by ad exchanges.<sup>770</sup> One Google employee remarking on these developments described SSPs' traditional yield management business as "dying."<sup>771</sup>

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<sup>769</sup> Gotham Ads, "The Evolution of SSPs: From Ad Servers to Programmatic Powerhouses," *LinkedIn*, October 11, 2023, available at <https://www.linkedin.com/pulse/evolution-ssps-from-ad-servers-programmatic-powerhouses-gothamads>; "The Evolution Of The Supply Side Platform," *Sharethrough*, December 14, 2015, available at <https://www.sharethrough.com/blog/the-evolution-of-the-supply-side-platform>.

<sup>770</sup> Gotham Ads, "The Evolution of SSPs: From Ad Servers to Programmatic Powerhouses," *LinkedIn*, October 11, 2023, available at <https://www.linkedin.com/pulse/evolution-ssps-from-ad-servers-programmatic-powerhouses-gothamads> ("SSPs evolved into more transparent, exchange-based business models to capitalize on the growing popularity of RTB as buyers embraced this form of transaction."); "The Evolution Of The Supply Side Platform," *Sharethrough*, December 14, 2015, available at <https://www.sharethrough.com/blog/the-evolution-of-the-supply-side-platform> ("As buyers became increasingly bullish on RTB, the supply side platforms evolved into more transparent, exchange-based business models to capitalize on this growing form of transaction."); GOOG-DOJ-13281019 at 020, 021 ("Admeld's YM business is shrinking at [REDACTED] YoY and that's with the best ad network optimization service on the planet. The AdX version of this service is an emulation [o]f Admeld with higher pricing and reduced customer service. Their main competition will be Rubicon and Pubmatic.").

<sup>771</sup> GOOG-DOJ-13281019 at 020 ("The only data we have in that area is Admeld's business which is currently dying. [...] The reality is that ad networks are alive and well, data collection businesses are alive and well, and Admeld's ad network business is not.").

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245. An illustrative and non-exhaustive list of companies that provide ad exchanges/SSPs today includes Google, Index Exchange,<sup>772</sup> OpenX,<sup>773</sup> Criteo,<sup>774</sup> Microsoft (Xandr),<sup>775</sup> Magnite,<sup>776</sup> PubMatic,<sup>777</sup> FreeWheel,<sup>778</sup> Sovrn,<sup>779</sup> Equativ,<sup>780</sup> 33Across,<sup>781</sup> Kargo,<sup>782</sup> Nexxen,<sup>783</sup> Onetag,<sup>784</sup> Sharethrough,<sup>785</sup> Sonobi,<sup>786</sup> and TripleLift.<sup>787</sup>

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<sup>772</sup> “One Exchange. Every Channel.” *Index Exchange*, available at <https://www.indexexchange.com/> (“We’re a global advertising marketplace delivering more value to media owners and marketers”); *see also* Gans Report, ¶ 181; Weinberg Report, Footnotes 160, 207.

<sup>773</sup> “The Most Innovative Independent Supply-Side Platform,” *OpenX*, available at <https://www.openx.com/>; “Publishers,” *OpenX*, available at <https://www.openx.com/publishers/>; *see also* Gans Report, ¶¶ 112, 181; Chandler Report, ¶ 188 (included in the section on “Ad Exchanges”); Weinberg Report, Footnote 102.

<sup>774</sup> “Commerce Grid: Commerce has evolved. It’s time the supply-side platform did, too.” *Criteo*, available at <https://www.criteo.com/platform/commerce-grid/> (“Maximize monetization with the only SSP purpose-built for commerce”).

<sup>775</sup> “Microsoft Monetize SSP,” *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en/solutions/technology/microsoft-monetize/monetize-ssp>; *see also* Gans Report, ¶ 181; Chandler Report, ¶ 189 (included in the section on “Ad Exchanges”).

<sup>776</sup> “You work hard to build your audience. Together, we’ll make every impression count.” *Magnite*, available at <https://www.magnite.com/sellers/>; *see also* Gans Report, ¶ 181; Chandler Report, ¶ 190 (included in the section on “Ad Exchanges”).

<sup>777</sup> “PubMatic SSP: Maximize Advertising Revenue and Control How Your Audiences are Accessed,” *PubMatic*, available at <https://pubmatic.com/products/pubmatic-ssp-for-publishers/>; Playwire Technical Team, “The Best Ad Exchanges for Publishers in 2024,” *Playwire*, available at <https://www.playwire.com/blog/best-ad-exchanges-for-publishers>; *see also* Gans Report, ¶¶ 112, 181.

<sup>778</sup> “For Sellers: SupplySuite,” *FreeWheel*, available at <https://www.freewheel.com/suppliesuite> (“Our supplier technology offers a unified platform that enables access to demand and fluid delivery across all endpoints. Use our technology to connect directly to buyers, reduce fragmentation, and activate first- and third-party data.”).

<sup>779</sup> “Ad Exchange: Earn More from Every Ad.” *Sovrn*, available at <https://www.sovrn.com/exchange/>.

<sup>780</sup> “SSP Marketplace,” *Equativ*, available at <https://equativ.com/solutions/earn/ssp/> (“Transact the way you want through PMPs, PG, Direct Deals, or open auction. Our cookieless-ready SSP marketplace offers a single point to access unlimited premium supply and audience data.”); *see also* Gans Report, ¶ 142.

<sup>781</sup> “Lexicon for Publishers: Built for Publisher Growth and Independence,” *33Across*, available at <https://www.33across.com/lexicon-for-publishers/addressable-formats/> (“We’ve re-architected our supply-side platform to help publishers depend less on browsers[.]”).

<sup>782</sup> “Brand Safety,” *Kargo*, available at <https://www.kargo.com/brand-safety> (“Transparency, quality, and supporting premium publishers are core to Kargo’s mission, as we strive to be the cleanest, highest-performing ad exchange available.”).

<sup>783</sup> “Working Harder, So Your Digital & CTV Inventory Can Work Hardest,” *Nexxen*, available at <https://www.nexxen.com/broadcasters-publishers> (“Get closer to buyers and increase the value of your inventory. Use our self-service SSP tools to price, layer on data, package and sell PMP/PG deals as you access untapped, unique demand through our DSP.”). Nexxen’s SSP is the former SSP Unruly. *See* “Tremor International Group Rebrands as Nexxen,” *Nexxen*, June 12, 2023, available at <https://investors.tremorinternational.com/news-releases/news-release-details/tremor-international-group-rebrands-nexxen-0>.

**2. Demand-side platforms emerged to help advertisers manage the complexity of real-time bidding.**

246. Once advertisers had the ability to bid on individual impressions in real time, and as the number of ad exchanges and SSPs grew, ad buying tools called demand-side platforms (DSPs) emerged to help advertisers synthesize the available data on the user, website, and ad creatives and manage the bidding process across multiple exchanges and SSPs.<sup>788</sup> **Figure 28** shows where DSPs fit into the ad tech industry at the time.<sup>789</sup>

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<sup>784</sup> Tom Jenen, “How to make the most of next-generation SSPs,” *Performance Marketing World*, March 30, 2023, available at <https://www.performancemarketingworld.com/article/1817855/next-generation-ssps> (“Tom Jenen, CRO at Onetag, discusses how publishers can make the most of a next-generation SSP that pursues bespoke quality, efficiency, and ease of implementation.”).

<sup>785</sup> “Sharethrough Ad Exchange Supply Policy,” *Sharethrough*, June 28, 2022, available at <https://www.sharethrough.com/sharethrough-supply-policy> (“As one of the top independent omnichannel ad exchanges in the world, the Sharethrough Ad Exchange [...] connects advertisers & publishers by leveraging their unique technology to enhance every impression by rendering a higher-performing banner, video, CTV or native ad that dynamically fits into any placement on any domain, application and other digital asset[.]”).

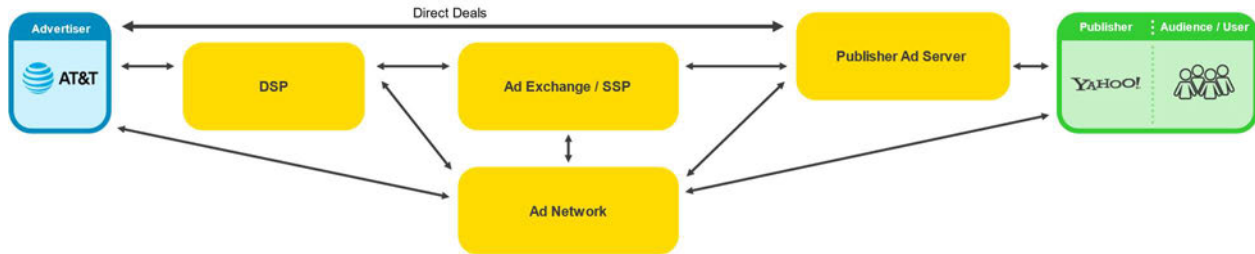
<sup>786</sup> “The Importance of Brand Safety in Programmatic Advertising,” *Sonobi*, July 17, 2023, available at <https://sonobi.com/news/brand-safety-programmatic-advertising/> (“As advertisers seek to protect their brand image and deliver content to the right audiences, the need for robust tools and strategies to ensure brand safety has become increasingly important. Sonobi, a leading supply-side platform (SSP), recognizes this challenge and has developed a multi-faceted approach to safeguarding brands.”).

<sup>787</sup> “A Different Kind of Exchange: Welcome to the Essential Marketplace,” *TripleLift*, available at <https://triplelift.com/uk/essential-marketplace/> (“TripleLift is the only major supply-side exchange designed to make advertising better for everyone – advertisers, publishers and consumers.”); “Two Heads Are Better Than One: TripleLift Acquires 1plusX,” *1plusX*, available at <https://www.1plusx.com/blog/two-heads-are-better-than-one-triplelift-acquires-1plusx> (“We just announced that TripleLift has acquired 1plusX [...] TripleLift is the advertising technology company reinventing ad placement at the intersection of creative, media, and data. Its marketplace serves the world’s leading brands, publishers, streaming companies, and demand-side platforms, executing over 1 trillion ad transactions every month.”); Chris Swanicke, “TripleLift Raises \$4M For RTB-Based Native Ad Exchange,” *AdExchanger*, March 5, 2014, available at <https://www.adexchanger.com/online-advertising/triplelift-raises-4m-for-rtb-based-native-ad-exchange/> (“Berry said TripleLift’s growth is driven by demand on the publisher side, and the focus will be on building on its existing native ad exchange.”).

<sup>788</sup> “The Arrival of Real-Time Bidding and What it Means for Media Buyers,” *Google*, July 2011, available at <https://www.rtbchina.com/wp-content/uploads/2012/03/Google-White-Paper-The-Arrival-of-Real-Time-Bidding-July-2011.pdf>, at p. 3; Mike Sweeney, “What Is a Demand-Side Platform (DSP) and How Does It Work?” *Clearcode*, January 31, 2024, available at <https://clearcode.cc/blog/demand-side-platform/> (“Once an advertiser[] has set up their campaigns in a DSP, including targeting and creatives (ads), the DSP then bids on impressions offered by ad exchanges and SSPs. So each time a DSP receives a request from an ad exchange or SSP telling it that there is an impression available, the DSP analyzes the data about the user and decides how much this particular user is worth based on their relevance to the media buyer.”).

<sup>789</sup> “Let Right Media Become your Demand Side Platform (DSP) Partner,” *Right Media*, April 8, 2010, available at <https://web.archive.org/web/20100408005005/http://www.rightmedia.com/demand-side-platforms> (“DSPs work on behalf of advertisers or agencies to access quality supply at scale and market rates. Using insights and data from marketers and other sources, DSPs enable advertisers to seamlessly buy across exchanges and other large

**Figure 28. Introduction of Real-Time Bidding and Emergence of DSPs**



**Notes:**

[1] This figure is reproduced as **Figure D-6** in **Appendix D**.

247. DSPs provided their clients with a single interface that allowed them to connect with multiple ad networks, ad exchanges, and SSPs to buy ad slots through an automated bidding process on an impression-by-impression basis across various properties (e.g., websites with original content, retailer websites, mobile apps, connected TV), all within a matter of milliseconds.<sup>790</sup> DSPs also evolved to offer comprehensive data analytics on campaign

pools of supply.”); “Invite Media’s Turner Discusses New Self-Service ‘Bid Manager’ for Display,” *AdExchanger*, April 20, 2009, available at <https://www.adexchanger.com/online-advertising/ad-exchanges-bid-manager-media-buying-invite-media/> (“[Invite Media’s] Bid Manager allows an agency, ad network or media buyer to automatically buy and manage display media across multiple ad exchanges through one interface.”); “How it Works,” *DataXu*, September 22, 2009, available at <https://web.archive.org/web/20090922214544/http://www.dataxu.com/how-it-works.php> (“[T]he DataXu platform values, bid manages and buys ads on an impression-by-impression basis, across the ad exchanges operated by Google, Yahoo and others.”).

<sup>790</sup> “Invite Media’s Turner Discusses New Self-Service ‘Bid Manager’ for Display,” *AdExchanger*, April 20, 2009, available at <https://www.adexchanger.com/online-advertising/ad-exchanges-bid-manager-media-buying-invite-media/> (“Invite [Media] has built what we call a ‘universal buying platform,’ Bid Manager. In one sentence, Bid Manager allows an agency, ad network or media buyer to automatically buy and manage display media across multiple ad exchanges through one interface. [...] Our platform, Bid Manager, is entirely self-service.”); “How it Works,” *DataXu*, September 22, 2009, available at <https://web.archive.org/web/20090922214544/http://www.dataxu.com/how-it-works.php> (“DataXu offers the first real-time ad optimization platform for advertisers. [...] [T]he DataXu platform values, bid manages and buys ads on an impression-by-impression basis, across the ad exchanges operated by Google, Yahoo and others. [...] Our real-time system picks and prices individual impressions as they become available, in less than 150 milliseconds.”); “Ad Network Vs. Ad Exchange Vs. DSP: Why Are They Different?” *Growth Marketing Genie*, available at <https://growthmarketinggenie.com/blog/ad-network-vs-ad-exchange-vs-dsp/> (“A demand side platform (DSP) is an advertising software used by advertisers to buy ad space through real-time bidding. It allows them to acquire advertising space from multiple suppliers simultaneously, including ad networks, ad exchanges, and individual publishers. DSPs group all the available suppliers on one side to simplify buying ad inventory for advertisers.”); Brock Munro, “What is the Difference Between Ad Network and DSP?” *Publift*, June 28, 2024, available at <https://www.publift.com/blog/ad-networks-vs-dsp/> (“Demand Side Platforms allow media buyers (who ‘demand’ ad inventory) to buy ad inventory from multiple suppliers at the same time, such as publishers, ad networks, and ad exchanges.”).



performance across multiple ad exchanges at a much more granular level than what was previously available.<sup>791</sup>

248. An illustrative and non-exhaustive list of companies that provide DSPs today includes The Trade Desk,<sup>792</sup> Amazon DSP,<sup>793</sup> Adobe,<sup>794</sup> StackAdapt,<sup>795</sup> Yahoo,<sup>796</sup> Microsoft (Xandr),<sup>797</sup>

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<sup>791</sup> Mike Sweeney, “What Is a Demand-Side Platform (DSP) and How Does It Work?” *Clearcode*, January 31, 2024, available at <https://clearcode.cc/blog/demand-side-platform/> (“Here are some of the main functions DSPs provide media buyers: [...] Provide real-time reporting via advanced analytics.”); “Benefits,” *DataXu*, September 22, 2009, available at <https://web.archive.org/web/20090922214528/http://www.dataxu.com/benefits.php> (“Today, buyers must rely on the analytics and targeting algorithms provided by ad sellers. DataXu puts the power in the hands of advertisers and ad agencies, with buyer-driven optimization from beginning to end. [...] The DataXu system can evaluate campaign performance based on over 100 data parameters, covering details like consumer location, time of day, site content type, creative concept, ad type, etc. [...] Integrated reporting across multiple exchanges delivers a much more accurate view of campaign performance and reduces administrative burden for advertisers.”).

<sup>792</sup> “Demand Side Platform: The leading independent DSP built for data-driven marketers,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/our-platform/dsp-demand-side-platform>; *see also* Gans Report, ¶ 286.

<sup>793</sup> “Amazon DSP: Your brand in new places.” *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/amazon-dsp>; *see also* Gans Report, ¶ 286.

<sup>794</sup> “One demand-side platform to rule them all.” *Adobe Experience Cloud*, available at <https://business.adobe.com/products/advertising/demand-side-platform.html>; *see also* Gans Report, ¶ 286.

<sup>795</sup> “StackAdapt is the Highest Performing and Easiest to Use Demand-Side Platform (DSP),” *StackAdapt*, available at <https://www.stackadapt.com/best-demand-side-platform-dsp>.

<sup>796</sup> “Yahoo DSP: Advertising Solutions,” *Yahoo! Advertising*, available at <https://www.advertising.yahoo.com/our-dsp>. Instead of describing Yahoo as a company providing a DSP, Professor Gans characterizes Yahoo as a participant in the market for “ad buying tools for small advertisers.” *See* Gans Report, ¶ 229, Section IV.E.

<sup>797</sup> “About Microsoft Invest,” *Xandr Platform*, February 12, 2024, available at [https://docs.xandr.com/bundle/invest\\_invest-standard/page/topics/about-invest.html](https://docs.xandr.com/bundle/invest_invest-standard/page/topics/about-invest.html); *see also* Gans Report, ¶ 286.

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Nexxen,<sup>798</sup> Adform,<sup>799</sup> Beeswax,<sup>800</sup> Simpli.fi,<sup>801</sup> Basis Technologies (formerly Centro),<sup>802</sup> Viant Technology (Adelphic),<sup>803</sup> Arpeely,<sup>804</sup> Quantcast,<sup>805</sup> and Verve,<sup>806</sup> among others.

249. Google’s DSP is Display & Video 360 (DV360), formerly known as DoubleClick Bid Manager (DBM).

250. In addition to DSPs, advertisers can also buy display ads via ad networks, discussed above in **Section VII.C**. Although Professor Gans characterizes certain companies that provide ad networks—including Google (via Google Ads and AdSense), Taboola, Criteo, and Microsoft—as participants in the market for “ad buying tools for small advertisers,”<sup>807</sup> in my experience, that is not a term used in the industry. Professor Gans also claims that “ad buying tools for small advertisers” have “peculiar characteristics and uses,” but many of the traits that he references—including “connect[ing] to ad exchanges and publisher ad servers,” “enabl[ing] the purchasing of ad inventory,” “optimizing their targeting and impact within their campaign budget,” and “track[ing] metrics around campaign performance”<sup>808</sup>—also apply to DSPs. Indeed,

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<sup>798</sup> “One platform. Endless opportunities.” *Nexxen*, available at <https://www.nexxen.com/>.

<sup>799</sup> “The Adform Demand Side Platform,” *Adform*, available at <https://site.adform.com/solutions/demand-side-platform/>.

<sup>800</sup> “Demand Side Solutions,” *Beeswax*, available at <https://www.beeswax.com/products/>.

<sup>801</sup> “Media Buying Solutions,” *Simpli.fi*, available at <https://simpli.fi/our-solutions/media-buying-solutions>.

<sup>802</sup> “Top-Ranked Demand Side Platform (DSP),” *Basis Technologies*, available at <https://basis.com/technology/dsp>; “Centro Rebrands as Basis Technologies on its 20<sup>th</sup> Corporate Anniversary,” *Basis Technologies*, October 15, 2021, available at <https://basis.com/news/centro-rebrands-as-basis-technologies-on-its-20th-corporate-anniversary>.

<sup>803</sup> “Viant DSP (Demand Side Platform) Advertising,” *Viant*, available at <https://www.viantinc.com/solutions/dsp/> (“Our DSP empowers brands and agencies to reach consumers seamlessly across all programmatic channels and formats. With Adelphic, our clients can manage omnichannel campaigns across all channels without having to switch between platforms.”).

<sup>804</sup> “List of Processors,” *The ViewPoint*, available at <https://theviewpoint.com/list-of-processors/> (“Arpeely – Demand Side Platform”).

<sup>805</sup> Matthew Schrag, “Going Beyond a Demand-Side Platform (DSP),” *Quantcast*, available at <https://www.quantcast.com/blog/going-beyond-a-demand-side-platform-dsp/>.

<sup>806</sup> “Capture attention of global audiences,” *Verve Group*, available at <https://verve.com/advertisers/>.

<sup>807</sup> Gans Report, ¶ 229, Section IV.E. Notably, the source that Professor Gans cites for Microsoft references its ad network—Microsoft Audience Network. *See* Gans Report, Footnote 224.

<sup>808</sup> Gans Report, ¶ 232; *see also* Gans Report, ¶ 225 (“connecting with exchanges and sellers of ad inventory, optimizing demographic and cross device targeting, managing advertising campaigns and remarketing campaigns, collecting data on campaigns’ performance”).



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ad buying tools are not segmented according to customer size,<sup>809</sup> or even according to advertising type.<sup>810</sup>

251. As depicted in **Figure 29**, Google Ads—which includes the advertiser-facing side of Google’s ad network—enables advertisers to buy ad space (1) on Google’s owned-and-operated properties (like Search, YouTube, and Gmail); (2) from publishers using Google’s platforms—AdSense, Google Ad Manager (which includes Google’s ad exchange functionality), and AdMob (which focuses on in-app inventory); and (3) from publishers using third-party ad exchanges (*e.g.*, PubMatic, OpenX, Microsoft (Xandr), Magnite, Index Exchange).<sup>811</sup> These capabilities evolved over time. Originally known as AdWords, Google Ads launched in 2000 as a tool that enabled advertisers to place ads in Google’s search results based on specific

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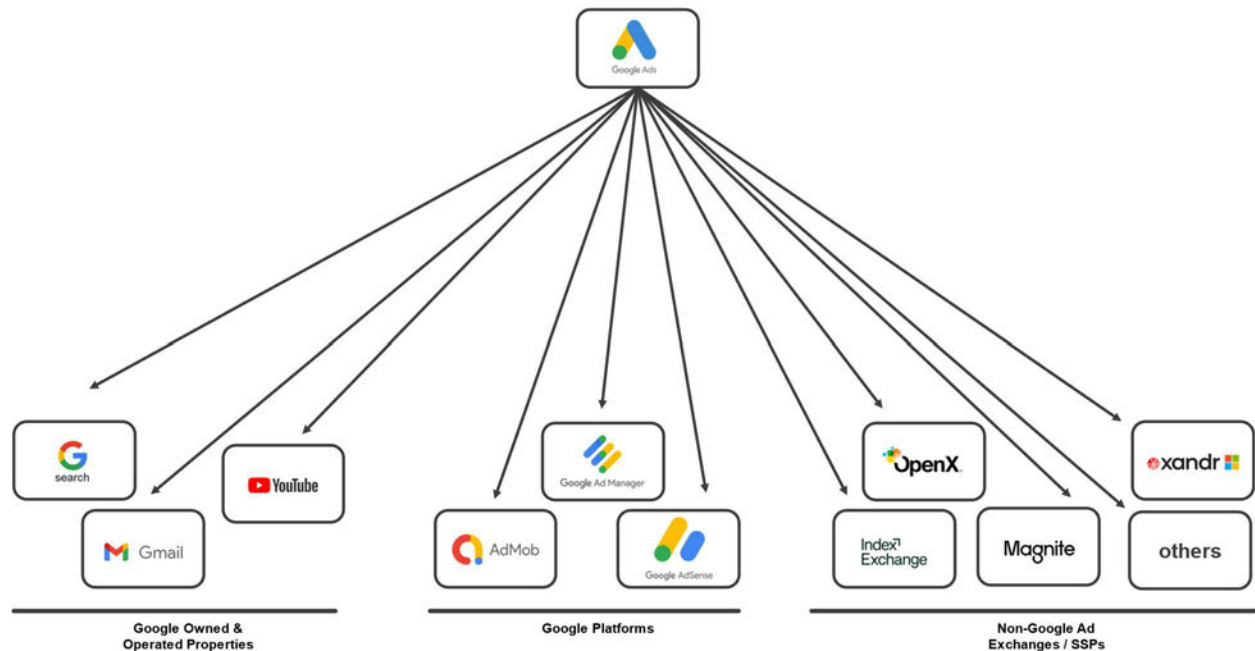
<sup>809</sup> See, *e.g.*, GOOG-AT-MDL-007173623 (Deposition of [REDACTED], *In Re Google Antitrust Litigation*, March 30, 2021) at 731:24-25 (“[S]ize is not the only determinant of what an advertiser might want to do.”); Deposition of Google ([REDACTED]), *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, April 5, 2024, 171:9-172:5 (“Q. Do DV360 customers tend to be more sophisticated, large customers? A. I think that’s a broad generalization. Both Display & Video 360 and Google Ads have a mix of sophisticated and less sophisticated advertisers whose ads run across. Q. So [...] there’s no clear demographic of DV360 customers tend to be more sophisticated, whereas Google Ads customers tend to be more smaller? [...] A. [...] [S]ome advertisers who would consider themselves sophisticated on both platforms, and there are advertisers who would consider themselves less sophisticated on both platforms.”).

<sup>810</sup> Professor Gans acknowledges that both small and large advertisers use “ad buying tools” to purchase “several types of advertising,” including “display advertising, in-app advertising, video advertising, [and] Connected TV advertising[.]” See Gans Report, ¶¶ 226, 284. Indeed, Amazon DSP, The Trade Desk, Criteo, and Microsoft Invest each facilitate the purchase of multiple types of advertising. See “Amazon DSP ad dimensions and specifications,” *Amazon Ads*, available at <https://advertising.amazon.com/resources/ad-specs/dsp>; “Omnichannel Programmatic Advertising: Reach your audience where it matters, when it matters,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/our-platform/omnichannel-advertising>; “Glossary Of Terms: Digital Advertising, A-to-Z,” *Criteo*, available at <https://www.criteo.com/digital-advertising-glossary/>; “Microsoft Invest,” *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en-us/solutions/xandr/xandr-premium-programmatic-advertising>.

<sup>811</sup> “Google Ads gives you many ways to be seen with Performance Max,” *Google Ads*, available at <https://ads.google.com/home/>; “How AdSense works,” *Google AdSense Help*, available at <https://support.google.com/adsense/answer/6242051?hl=en> (“The AdSense Program [...] delivers ads served by Google Ads to your site.”); “About the ad sources included in the AdMob Network,” *Google AdMob Help*, available at <https://support.google.com/admob/answer/10989569?hl=en> (“Google (Google Ads, Display & Video 360) is the Google demand that’s included as part of the AdMob Network.”); GOOG-DOJ-13518329 at 330-331 (noting launch of AwBid, which enabled AdWords advertisers to “bid[] on external exchange inventory,” and that AwBid had launched for Rubicon (now Magnite), Casale Media (now Index Exchange), and OpenX); GOOG-DOJ-AT-02096475 at 476 (indicating that “[A]d[W]ords bidding (AWBid) on Appnexus inventory” had “[l]aunched”); GOOG-DOJ-09916352 at 352 (“AWBid stands for AdWords Bidder and enables cross-exchange buying for AdWords remarketing campaigns.”); “Google AdWords is now Google Ads,” *Google Ads Help*, available at <https://support.google.com/google-ads/answer/9028765?hl=en>.

keywords.<sup>812</sup> Subsequently, Google enabled advertisers using AdWords to purchase display ads from third-party publishers via AdSense in addition to search ads. Google Ads began bidding into AdX in 2009, and it began bidding into other ad exchanges when Google launched the AwBid program in June 2015.<sup>813</sup>

**Figure 29. Google Ads Allows Buyers to Purchase Inventory from Many Sources**



252. While I have used simplified figures to illustrate the evolution of the ad tech stack over time, it is important to remember that many firms, in multiple levels of the ad tech stack, are involved in matching each impression to an advertiser. **Figure 30** depicts some of that complexity with an illustrative example of multiple advertisers and ad agencies using a variety of

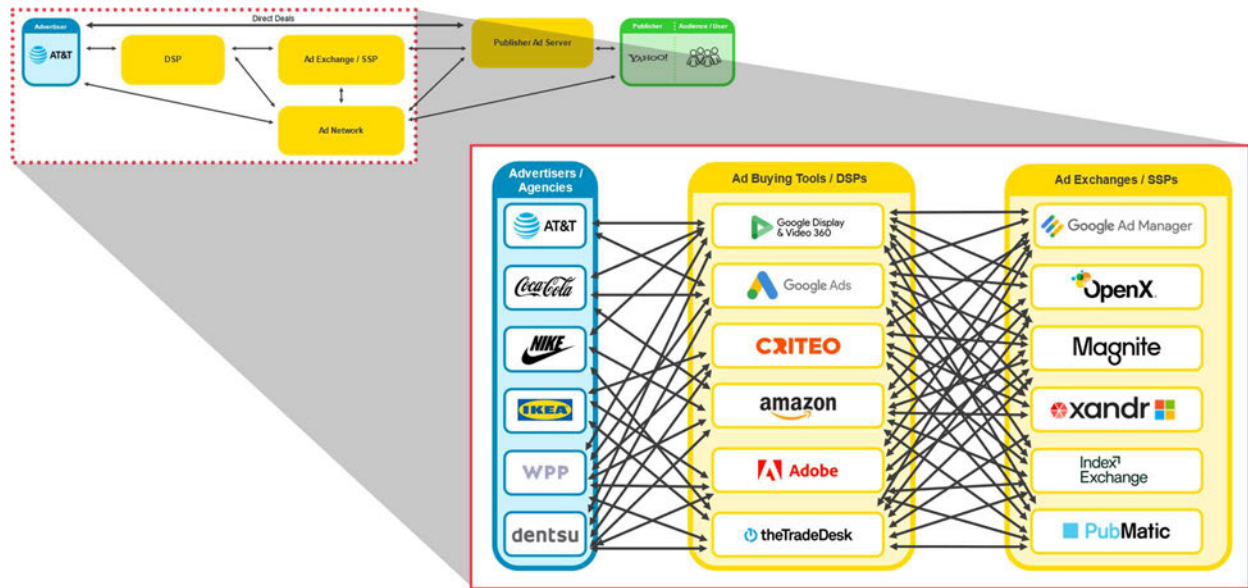
<sup>812</sup> Jemima Kiss, “Ten years of online advertising with Google Adwords,” *The Guardian*, October 25, 2010, available at <https://www.theguardian.com/media/2010/oct/25/advertising-google-adwords> (AdWords, “the sponsored listings that appear next to search results” provided businesses with “the ability to access ‘hot leads,’ to find a customer at the point when they needed that service” and “[n]early 97% - \$22.889bn – of Google’s 2009 revenues were generated by advertising, and the majority of that through AdWords[.]”).

<sup>813</sup> Kelvin Newman, “A History of Google AdWords and Google Ads: Revolutionizing Digital Advertising & Marketing Since 2000,” *PPC Hero*, April 11, 2024, available at <https://www.ppchero.com/a-history-of-google-adwords-and-google-ads-revolutionizing-digital-advertising-marketing-since-2000/>; “Introducing cross-account campaign management and reporting enhancements for manager accounts (MCC),” *Google Inside AdWords*, June 4, 2015, available at <https://adwords.googleblog.com/2015/06/introducing-cross-account-campaign.html>; GOOG-AT-MDL-006218271 at 280.

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ad buying tools and possible bidding paths to purchase a single impression that a publisher made available on multiple ad exchanges.

**Figure 30. Illustrative Example of Possible Bidding Paths on an Impression**



**Notes:**

[1] Lines in the figure demonstrate possible bidding paths between examples of advertisers/agencies, companies providing ad buying tools/DSPs, and companies providing ad exchanges/SSPs; the examples presented are not meant to represent actual transactions involving the companies.

[2] This figure is reproduced as **Figure D-7** in **Appendix D**.

**Sources:** “Supported display exchanges,” *Display & Video 360 Help*, available at <https://support.google.com/displayvideo/table/3267029?hl=en>; GOOG-DOJ-13518329 at 330-331, 334; GOOG-DOJ-AT-02096475 at 476, 480; “Our partners,” *Criteo*, available at <https://www.criteo.com/privacy/our-partners/>; [REDACTED]

[REDACTED] “SSP Partners,” *Adobe*, December 17, 2023, available at <https://experienceleague.adobe.com/docs/advertising/dsp/inventory/ssp-partners.html>; “Our Partners: Expand your reach with 350+ partners,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/our-platform/our-partners/partner-directory>; “A Look Under the Hood, Amazon’s DSP,” *Mindstream Media Group*, available at <https://mindstreammediagroup.com/a-look-under-the-hood-amazons-dsp/> (“[A]ds can be placed outside of Amazon through the Amazon DSP. Audiences can be reached on third-party websites and apps, and through other exchanges like AppNexus, OpenX, etc.”); [REDACTED]

[REDACTED] “DSP partners for Programmatic Guaranteed,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/9238466>; “Third party providers,” *Xandr Platform*, February 7, 2024, available at <https://docs.xandr.com/bundle/service-policies/page/third-party-providers.html>; “AT&T Wireless found more leads and conversions with Google AdWords,” *Google Ads*, available at <http://www.google.com/ads/att.pdf>; Venus Ozdemir, “How Coca-Cola

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Middle East reached millions of people with just 1 adaptable video,” *Think with Google*, August, 2023, available at <https://www.thinkwithgoogle.com/intl/en-emea/future-of-marketing/creativity/coca-cola-personalized-ads-video/>; “Experiment: How Coca-Cola Vietnam made their ad strategy more efficient by pushing YouTube’s reach,” *Think with Google*, July 2021, available at <https://www.thinkwithgoogle.com/intl/en-apac/marketing-strategies/video/coca-cola-vietnam-youtube/>; “How Coca-Cola helped feed families in need in Italy with Amazon Ads’ help,” *Amazon Ads*, available at <https://advertising.amazon.com/library/case-studies/coca-cola-italy/>; “Nike’s Social Media and (third party) Advertising Cookies,” *Nike*, available at [https://agreementservice.svs.nike.com/nl/en\\_gb/rest/agreement?requestType=redirect&agreementType=adnetwork&country=NL&language=en&uxId=com.nike.unite](https://agreementservice.svs.nike.com/nl/en_gb/rest/agreement?requestType=redirect&agreementType=adnetwork&country=NL&language=en&uxId=com.nike.unite); Daniel Alegre, “Helping shoppers buy effortlessly from Best Buy, Nike, and Sephora over the holidays,” *Google Ads & Commerce Blog*, October 16, 2018, available at <https://blog.google/products/ads/shopping-actions-best-buy-nike-sephora/>; “‘The tech is good enough’: Why Amazon’s DSP is becoming a rival to Google,” *Digiday*, October 27, 2017, available at <https://digiday.com/marketing/tech-good-enough-amazons-dsp-becoming-rival-google/>; “Case Study: IKEA boosts ad spend ROI through Google Search Ads 360,” *Google Marketing Platform*, available at <https://marketingplatform.google.com/about/resources/ikea-boosts-ad-spend-roi-search-ads-360/>; Lara O’Reilly, “The world’s biggest advertising company says Google is now its biggest partner – and it spent \$2.9 billion on Google ads last year,” *Business Insider*, March 9, 2015, available at <https://www.businessinsider.com/wpp-says-google-is-its-biggest-media-partner-2015-3>; “GroupM Enhances Creator Content Amplification Capabilities Globally With Amazon Ads,” *GroupM*, October 17, 2023, available at <https://www.groupm.com/newsroom/groupm-enhances-creator-content-amplification-capabilities-globally-with-amazon-ads/>; “WPP Investor Day: Creativity powered by technology,” *WPP*, January 15, 2020, available at <https://www.wpp.com/-/media/project/wpp/files/investors/2020/wpp-investorday-15012020.pdf>; “Adobe Marketing Cloud,” *Gourmet Ads*, available at <https://publishers.gourmetads.com/partnerships/adobe-marketing-cloud/>; “WPP Recognized as a Leader in the Forrester Wave™: Commerce Services, Q1 2021,” *GroupM*, March 22, 2021, available at <https://www.groupm.com/wpp-recognized-as-a-leader-in-the-forrester-wave-commerce-services-q1-2021/> (“With unparalleled expertise, we have more employees trained in Amazon, Google, Facebook, Walmart, Target, Criteo, Instacart (and more) than anyone else.”); “Instacart and The Trade Desk Partner to Enhance Programmatic Advertising for CPG Brands,” *GroupM*, October 19, 2023, available at <https://www.groupm.com/newsroom/instacart-and-the-trade-desk-partner-to-enhance-programmatic-advertising-for-cpg-brands/> (“GroupM[] will soon be able to build and activate Instacart-informed audiences across omnichannel media buys through The Trade Desk.”); “Tuning in: How dentsu increased YouTube ad recall by 188% with Google DV360 APIs,” *dentsu*, available at <https://www.dentsu.com/nl/en/how-dentsu-increased-youtube-ad-recall-with-google-dv360-api/>; “Certified Google Partner,” *dentsu*, available at <https://www.dentsu.com/us/en/global-alliance-partners/google-partnership/>; “Dentsu International,” *Amazon Ads*, available at <https://advertising.amazon.com/partners/directory/details/amzn1.ads1.ma1.f52s6k2jcccz66iz43nd08sax/Dentsu-International/>; “Tiger Beer brews up an outstanding, highly targeted, and cost-efficient campaign,” *The Trade Desk*, August 2, 2023, available at <https://www.thetradedesk.com/us/resource-desk/tiger-beer-crafts-holy-grail-marketing-campaign/>; “Adobe Platinum Partner,” *dentsu*, available at <https://www.dentsu.com/us/en/global-alliance-partners/adobe-partnership/>; “Unleashing creativity in all employees.” *Adobe Experience Cloud*, available at <https://business.adobe.com/customer-success-stories/dentsu-case-study.html>; “Clinique reaches two million new high-intent online shoppers in India with their game-changing OTT video ad strategy,” *Criteo*, available at <https://www.criteo.com/success-stories/clinique/>.

**I. Around 2014-2015, header bidding enabled auctions among ad exchanges, but had downsides for customers and internet users.**

253. A new technology known as *header bidding* first emerged in 2009 or 2010,<sup>814</sup> but it did not become prominent until around 2014-2015.<sup>815</sup> IAB incorporated header bidding support into version 2.5 of the OpenRTB standard in December 2016.<sup>816</sup> By 2017, between 65-70% of the North American publishers served by Google’s partnerships teams had adopted header bidding, and the header bidding impression volume for these publishers stood at 28 billion impressions per month.<sup>817</sup>

254. Header bidding is a technology that enables publishers to call one or more demand sources and run an auction among those demand sources. In particular, header bidding enables publishers to run an auction among ad exchanges, each of which in turn also run their own auctions.<sup>818</sup> It therefore enables a so-called “auction of auctions.”<sup>819</sup>

255. Publishers implement header bidding by embedding JavaScript code (a header bidding “wrapper”) within a webpage’s “header” code. As illustrated in **Figure 31**, header bidding is typically conducted in the following manner:

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<sup>814</sup> Tim Cross, “Who Invented What in Ad Tech? – Part Two,” *VideoWeek*, June 26, 2018, available at <https://videoweeek.com/2018/06/26/who-invented-what-in-ad-tech-part-two/>; “What Is Prebid and How It Works — A Comprehensive Guide,” *TargetVideo*, July 22, 2021, available at <https://target-video.com/what-is-prebid/>.

<sup>815</sup> Maciej Zawadziński, and Mike Sweeney, “What is Header Bidding and How Does it Work?” *Clearcode*, April 16, 2024, available at <https://clearcode.cc/blog/what-is-header-bidding/> (“It’s important to note that while the header-bidding process is nothing new — it’s been around for about 10 years — it really started to take off in 2014 and 2015 with the help of programmatic media buying.”); *see also* Gans Report, ¶ 115.

<sup>816</sup> “OpenRTB: Real-Time Bidding,” *IAB Tech Lab*, July 27, 2020, available at <https://iabtechlab.com/standards/openrtb/>.

<sup>817</sup> GOOG-DOJ-04387378 at 382, 384.

<sup>818</sup> “What is Header Bidding? How Header Bidding Improves on RTB,” *AdButler*, March 26, 2021, available at <https://www.adbutler.com/blog/article/what-is-header-bidding/> (“The exact date of header bidding’s origin is somewhat disputed. While multiple variants were introduced at around the same time as RTB in 2009, header bidding didn’t gain an identity for itself and attract mainstream usage until around 2014-2017.”); “‘An ad tech urban legend’: An oral history of how header bidding became digital advertisers’ hottest buzzword,” *Digiday*, June 16, 2017, available at <https://digiday.com/media/header-bidding-oral-history/> (“As seen in the Google Trends graph below, the phrase ‘header bidding’ took off online in the summer of 2015. [...] On June 18, 2015, AdExchanger published ‘The Rise Of ‘Header Bidding’ And The End Of The Publisher Waterfall,’ which was the first trade article to mention header bidding.”).

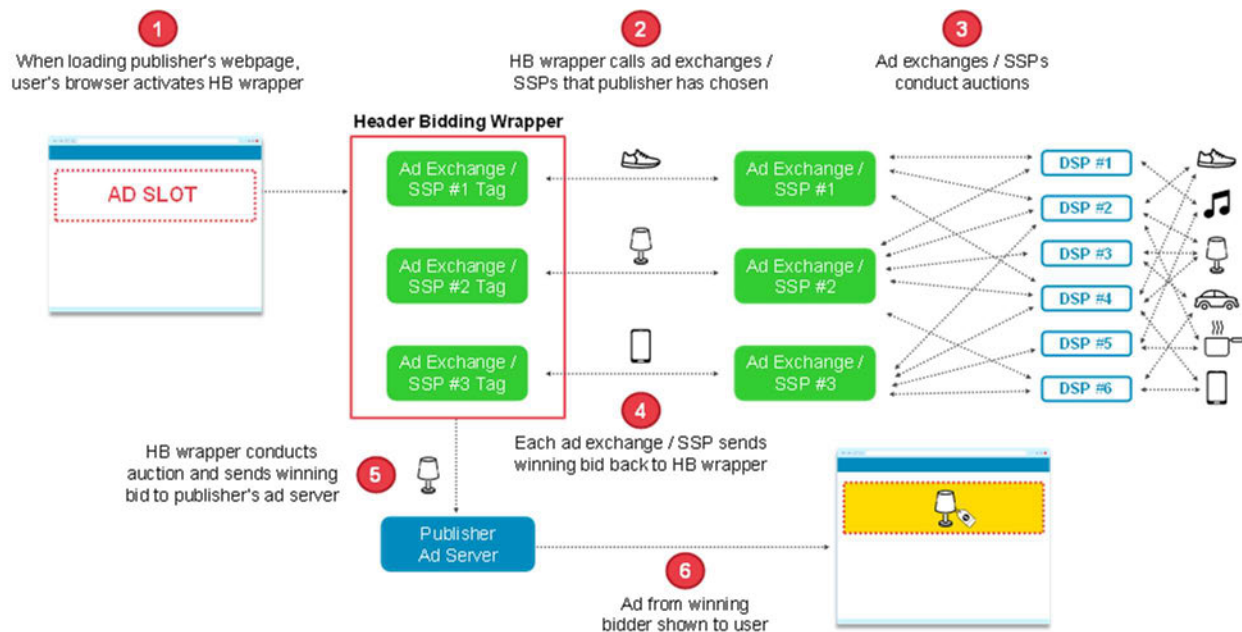
<sup>819</sup> *See, e.g.*, Eric Hochberger, “What is Header Bidding?” *Mediavine*, January 15, 2018, available at <https://www.mediavine.com/what-is-header-bidding/> (“Header bidding is essentially an auction of auctions, an opportunity for all the ad exchanges and networks to compete for every impression.”).



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- When a user visits the publisher’s website, the JavaScript code sends bid requests to the demand sources that the publisher specifies.
- Each demand source evaluates the bid request and chooses whether to respond by conducting an auction among interested bidders.<sup>820</sup>
- After receiving the winning bid from each demand source, the header bidding code selects the highest bid received. The winning bid is then typically sent to the publisher’s ad server.<sup>821</sup>

**Figure 31. Illustration of Header Bidding**



256. If a publisher configured header bidding and DFP a certain way, through the pre-existing process of Dynamic Allocation, the winning bid from header bidding could act as one of the

<sup>820</sup> “Header Bidding: A Byte-Sized Overview,” *IAB*, March 27, 2017, available at <https://www.iab.com/wp-content/uploads/2015/10/VidLab-HeaderBidding-3.27.17V10.pdf>.

<sup>821</sup> “Send All Bids to Ad Server,” *Prebid.js*, June 1, 2016, available at <https://web.archive.org/web/20160611072207/http://prebid.org:80/blog.html> (“Prebid is making it easier for publishers to send all header bidding bids, (not just the winning bid), to the ad server.”); “OpenX Bidder,” *OpenX*, June 21, 2017, available at <https://web.archive.org/web/20170708073533/https://docs.openx.com/Content/publishers/bidder.html> (“RTB providers, consisting of thousands of buyers, simultaneously bid on the impression. [...] The highest bid is inserted into the ad request and is passed to your ad server. Your ad server compiles all line items eligible for the ad request, including the bid passed from OpenX Bidder.”).

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parameters setting the price floor in Google’s AdX auction.<sup>822</sup> Some referred to this interaction between Dynamic Allocation and header bidding as creating a “last look” for Google because Dynamic Allocation gave AdX buyers an opportunity to win an impression after the publisher passed the winning bid from header bidding to Google and that bid could affect the price floor in AdX.<sup>823</sup>

257. Plaintiffs’ experts suggest that the emergence of this so-called “last look” was “designed as part of DA”<sup>824</sup> and was anticompetitive conduct geared towards exchanges that participated in header bidding.<sup>825</sup> But this ignores that DoubleClick invented Dynamic Allocation many years earlier (long before header bidding rose to prominence),<sup>826</sup> and that the “last look” emerged from publishers’ decision to use header bidding in conjunction with Google’s pre-existing technology, rather than from any changes that Google made to its products.<sup>827</sup>

258. Plaintiffs’ experts also largely fail to acknowledge that header bidding was rife with drawbacks and risks detrimental to publishers, advertisers, and—critically—users.

259. *First*, header bidding conducted in a user’s browser (commonly known as client-side header bidding<sup>828</sup>) increases the load time of the publisher’s website (“latency”) because the process of conducting the multi-step auction of auctions requires more time to complete before

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<sup>822</sup> Under Dynamic Allocation, DFP would pass the highest bid from non-AdX remnant demand sources as a floor to AdX buyers to see if they could out-bid the remnant price. *See* GOOG-DOJ-06525908 at 912; GOOG-AT-MDL-008842393 at 396.

<sup>823</sup> GOOG-DOJ-06525908 at 912 (“The best Ad Manager non-guaranteed line item is selected based on price. The non-guaranteed price is passed as a floor to AdX buyers (together with AdX floors configured by the publisher). This is what the industry refers [to] as ‘last look’, where AdX is called last to see if any bid can beat the remnant price[.]”).

<sup>824</sup> Gans Report, ¶ 596.

<sup>825</sup> *See, e.g.*, Gans Report, ¶¶ 594, 596-597; Chandler Report, ¶¶ 133-138; Weinberg Report, Section V.C.

<sup>826</sup> GOOG-DOJ-AT-01133273 at 277 (a document dated March 29, 2007 explaining “[k]ey features of DoubleClick Advertising Exchange,” which include, among others, “Dynamic allocation for sellers. DoubleClick Advertising Exchange automatically determines how to generate the highest return for every impression by dynamically allocating to the highest paying sales channel.”).

<sup>827</sup> GOOG-AT-MDL-008842393 at 398 (“The fact that AdX would be called after the header call has been characterized by some third parties as a ‘last look’ for AdX. But ‘last look’ was not designed to give AdX an advantage when competing against Header Bidding. It was simply the result of the Header Bidding auction taking place before the AdX auction ran and the way that publishers configured Header Bidding line items to work with Dynamic Allocation.”).

<sup>828</sup> Shubham Grover, “Client-side vs. Server-side Header Bidding: What to Choose?” *AdPushup*, December 14, 2022, available at <https://www.adpushup.com/blog/client-side-header-bidding-vs-server-side-header-bidding/>.

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an ad can be served.<sup>829</sup> Professor Gans notes the latency issues with client-side header bidding.<sup>830</sup> Dr. Chandler does not directly acknowledge the latency issue with header bidding, but he discusses how Google’s Open Bidding (*see* **Section VII.J**)—which he describes as “an alternative to header bidding”—“offered certain technical benefits, such as reduced latency and simplified implementation.”<sup>831</sup> The prolonged page load time would negatively impact the user experience,<sup>832</sup> which in turn would reduce the likelihood of an ad being served (*e.g.*, due to the user closing the webpage before the ad loaded) and ultimately impact publisher monetization.<sup>833</sup>

260. *Second*, header bidding led to an increase in *domain spoofing*<sup>834</sup> and ad fraud generally. Since publishers that use header bidding call multiple demand sources simultaneously, ad exchanges no longer have access to unique inventory as they did before header bidding. This makes it easier for fraudulent domains to impersonate reputable publishers by manipulating bid

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<sup>829</sup> “Header Bidding: A Byte-Sized Overview,” *IAB*, March 27, 2017, available at <https://www.iab.com/wp-content/uploads/2015/10/VidLab-HeaderBidding-3.27.17V10.pdf>, at pp. 2-3 (“The biggest challenge for header bidding is the risk of latency that publishers face. This comes to life in several ways: by increasing the page load times[,] by slowing how long it takes to get a bid from a bidder[, and] by taking longer to serve creative[.]”); GOOG-DOJ-AT-01027937 at 946; GOOG-DOJ-15223226 at 240.

<sup>830</sup> Gans Report, ¶ 118.

<sup>831</sup> Chandler Report, ¶¶ 123, 125.

<sup>832</sup> High latency leads to slow load times, which can frustrate users and lead them to abandon the website. In contrast, a smooth and fast user browsing experience helps keep visitors engaged and willing to interact with monetization elements such as ads or e-commerce features. *See* GOOG-DOJ-13351316 at 316 (“Research has shown that the longer users wait for a page to load the less engaged they are during their visit and the less likely they are to return.”).

<sup>833</sup> Michal Wlosik, “Client-Side vs. Server-Side Header Bidding: Pros and Cons,” *Clearcode*, January 23, 2024, available at <https://clearcode.cc/blog/pros-cons-client-side-server-side-header-bidding/> (“Because it adds a number of scripts in the page header, page-load times get longer, negatively affecting the user experience and resulting in fewer impressions loaded.”); Maciej Zawadziński, and Mike Sweeney, “The Benefits and Drawbacks Of Header Bidding For Publishers,” *Clearcode*, December 14, 2023, available at <https://clearcode.cc/blog/benefits-drawbacks-header-bidding/> (“Adding more scripts to a page slows down its page-load time, which has a negative effect on the user experience, results in fewer impressions loading, and lowers the likelihood of ads being viewed.”); Amanda Binns, “How Moving To Server-Side Header Bidding Reduces Latency,” *PubMatic*, February 22, 2018, available at <https://pubmatic.com/blog/server-side-header-bidding-reduces-latency/> (“Latency is problematic because it slows the ad and page load times, which disrupts the user experience, leads to timeouts, reducing fill and ultimately monetization.”); GOOG-DOJ-15189434 at 435; GOOG-DOJ-AT-00621267 at 267.

<sup>834</sup> Domain spoofing is usually done by “registering a domain that is similar to an existing domain in hopes of fooling users who mistype the web address.” *See* Shubham Grover, “What is Domain Spoofing? How to Prevent it,” *AdPushup*, December 11, 2022, available at <https://www.adpushup.com/blog/what-is-domain-spoofing/>; Yuyu Chen, “Domain spoofing remains a huge threat to programmatic,” *Digiday*, February 28, 2017, available at <https://digiday.com/marketing/domain-spoofing-remains-an-ad-fraud-problem/> (“The way [domain spoofing] works is that a buyer may see the URL for reputablewebsite.com [...] but, in reality, is buying from a completely unrelated site, disreputablewebsite.com.”).



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requests, which in turn makes it harder for buyers to verify that their ads are placed on the right website.<sup>835</sup> Moreover, the high volume of bids created by header bidding can also make ad fraud harder to detect.<sup>836</sup> Fraudsters have exploited header bidding to mask their fraudulent activities among the legitimate bids, making it more challenging to identify and filter out fraudulent bids in real time. In 2018, IAB Tech Lab’s CTO remarked that “[h]eader bidding led to publishers being more promiscuous in their demand partnerships, and more willing to turn on demand partners, which made it easier for bad actors to hide amongst all the activity.”<sup>837</sup>

261. *Third*, header bidding increased the risk of data leakage (meaning the unauthorized transmission of user data). Since header bidding contacts all demand sources simultaneously, the user data needed for effective targeting are exposed to all bidders.<sup>838</sup> Under the waterfall model, demand sources were called sequentially, and user data were exposed to only those demand sources that were asked to bid. In contrast, with header bidding, each potential bidder (including those that do not bid on impressions) receives access to data from all users who are served impressions on the publisher’s website.<sup>839</sup> Brian O’Kelley, the inventor of header bidding, noted that a bid request from header bidding could include extensive user-level data, including the

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<sup>835</sup> Ross Benes, “Blast from the past: Why old ad fraud tactics won’t die,” *Digiday*, October 30, 2017, available at <https://digiday.com/marketing/blast-past-old-ad-fraud-tactics-wont-die/> (“Prior to header bidding, publishers sold inventory by moving ad calls across supply-side platforms one at a time. Since SSPs weren’t all bidding at once, they had access to unique inventory. This gave ad buyers a check against domain spoofing because they knew which SSPs worked directly with particular publishers. But header bidding lets publishers simultaneously make ad calls to a bunch of SSPs. To bring in more competition to the [*sic*] increase prices for their inventory, publishers using header bidding began loading more SSPs on their browsers. This reduced the probability that a given SSP would have access to unique inventory, eliminating a sanity check for buyers. [...] [Header bidding] has also made old fraud new again because it increases the attack surface for the adversaries doing domain spoofing[.]”).

<sup>836</sup> Ross Benes, “Unraveling header bidding’s problem with user data,” *Digiday*, March 20, 2017, available at <https://digiday.com/media/header-bidding-security/> (“Header bidding also makes it easier for fraudsters to hide in the noise created by the vast amount of data points that come from multiple parties bidding on all available impressions.”).

<sup>837</sup> Sarah Sluis, “How Ads.txt Took Down 3ve, As The FBI Took Down Its Creators,” *AdExchanger*, December 3, 2018, available at <https://www.adexchanger.com/online-advertising/how-ads-txt-took-down-3ve-as-the-fbi-took-down-its-creators/>.

<sup>838</sup> GOOG-DOJ-AT-01027937 at 946.

<sup>839</sup> Ross Benes, “Unraveling header bidding’s problem with user data,” *Digiday*, March 20, 2017, available at <https://digiday.com/media/header-bidding-security/> (“While waterfalling is clunky, one benefit of this technique is that it limits how much user data the bidders could harvest, said Todd Garland, CEO of digital ad network BuySellAds. For example, if the highest-bidding network in the waterfall wins 50 percent of the impressions in the auction, then subsequently, half of the impressions for sale won’t get passed along to other networks. [...] But with header bidding having all calls go out simultaneously, each bidder can get access to data from all the users who were served impressions from the auction.”).

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URL of the page, the referring URL, the user's IP address, the user's browser information, the latitude and longitude of the user, the user's cookie ID, the user's gender and year of birth, and publisher-specific user data.<sup>840</sup> This creates risk of data leakage from publishers to buyers.<sup>841</sup>

262. *Fourth*, header bidding created billing issues for publishers. A traditional publisher ad server handles all aspects of inventory management, including serving ads and billing for the number of impressions served. However, ad serving and billing are not handled by the same system with header bidding. The ad server serves the ad, but the billing is done by the header bidding exchange (or other demand source). This can create discrepancies between the ad server's reports and the header bidding partners' reports about the number of impressions served and the amount to be billed.<sup>842</sup> In 2016, Google conducted an internal case study to analyze the revenue discrepancies for a particular publisher (Gannett SMG) between reports by DFP and those by header bidding partners. Based on the revenue data collected from six SSPs, Google estimated the publisher's losses from Index Exchange, Amazon, and Rubicon to be over 20% and from AppNexus to be 11%.<sup>843</sup>

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<sup>840</sup> "Brian O'Kelley," *Tech:NYC*, available at <https://www.technyc.org/leaders/brian-okelley>; Brian O'Kelley, "Data is fallout, not oil," *BOK on Ads*, February 23, 2017, available at <https://bokonads.com/data-is-fallout-not-oil/> ("Every one of these third-party vendors gets information about the user. Here's a subset of what they can find out when the browser makes the third-party call: [t]he user's IP address[,] [t]he user's cookie[,] HTTP header information (user agent, for instance)[.], [t]he domain of the page and probably the full URL[,], [t]he referrer (previous page loaded)[.] Here's the interesting one: any data that the publisher agreed to use to target the ad. How? If the insertion order says 'serve this ad only to men', assuming the publisher is adhering to the deal, then we now know that this is a male user.").

<sup>841</sup> Brian O'Kelley, "Data is fallout, not oil," *BOK on Ads*, February 23, 2017, available at <https://bokonads.com/data-is-fallout-not-oil/> ("As we have seen, there are many ways in the online advertising ecosystem that data leaks from publishers to buyers.").

<sup>842</sup> GOOG-TEX-00118629 at 634 ("Pubs cannot verify what's being bid = what's being paid[:] [S]erving and billing aren't handled by the same system[:]; incremental 5-10% discrepancies from having two differing sources of truth[.]"); James Curran, "For Publishers, Header Bidding Discrepancies Can Outweigh Revenue Lift," *AdExchanger*, July 8, 2016, available at <https://www.adexchanger.com/the-sell-sider/publishers-header-bidding-discrepancies-can-outweigh-revenue-lift/> ("Publishers need to create a more realistic calculation of header bidding revenue by factoring discrepancies into their line-item valuations. Some header bidding solutions can cause up to a 50% discrepancy between the publisher ad server impression reports and the impression reports from the programmatic partner."); GOOG-DOJ-AT-00621267 at 267; GOOG-DOJ-15223226 at 240.

<sup>843</sup> GOOG-DOJ-AT-01027937 at 955.

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263. *Fifth*, header bidding created situations where a single DSP would be called on by multiple exchanges to bid on the same impression on a publisher’s website.<sup>844</sup> This “auction duplication” can lead to advertisers unknowingly competing against themselves (“self-competition”) and paying higher prices than they otherwise would have.<sup>845</sup> Professor Gans acknowledges this issue in his report, stating that “[o]ne concern during the early implementation phase of Header Bidding was the possibility of duplicated bids or ‘self-competition’ – i.e., the same buyers may submit bids via multiple exchanges leading to ‘self-competition.’”<sup>846</sup> He further notes that “duplicated bids in Header Bidding might negatively affect publishers in the long term.”<sup>847</sup> Professor Gans largely dismisses this concern by asserting that “multiple industrial guidelines on Header Bidding suggested that the industry had realized and addressed the problem of duplicated bids,”<sup>848</sup> but, in the only example he provides (where “an industry guide recommended that publishers avoid using too many Header Bidding solutions as this will lead to ‘duplicate bids’”), he fails to acknowledge that the recommendation does not address the self-competition issue with header bidding itself, but rather with “using too many [h]eader [b]idding solutions.”<sup>849</sup>

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<sup>844</sup> “Understanding Supply Path Optimization: A Primer,” *PubMatic*, 2019, available at <https://pubmatic.com/wp-content/uploads/2019/06/SPO-Primer-0619.pdf>, at p. 6 (“Particularly since the advent of header bidding, many publishers have become SSP agnostic, with over 60 percent of publishers working with over ten exchanges. This inevitably results in auction duplication for buyers, who themselves have been SSP agnostic as well.”); GOOG-DOJ-15189434 at 435 (“[H]eader bidding can make buyers bid against themselves running 2 auctions for every impression.”).

<sup>845</sup> “Understanding Supply Path Optimization: A Primer,” *PubMatic*, 2019, available at <https://pubmatic.com/wp-content/uploads/2019/06/SPO-Primer-0619.pdf>, at p. 6 (“In the current auction environment, buyers bidding across multiple SSPs for the same inventory risk being overcharged. [...] When participating in multiple auctions for the same inventory, it becomes challenging for buyers to ensure those auctions are operating fairly and consistently.”); Sarah Sluis, “The Trade Desk Suppresses Bid Duplication Amid COVID-19 Traffic Surge,” *AdExchanger*, April 21, 2020, available at <https://www.adexchanger.com/platforms/the-trade-desk-suppresses-bid-duplication-amid-covid-19-traffic-surge/> (“The bid duplication The Trade Desk wants to remove arose as a quirk of header bidding.”).

<sup>846</sup> Gans Report, ¶ 627.

<sup>847</sup> Gans Report, ¶ 627.

<sup>848</sup> Gans Report, ¶ 627.

<sup>849</sup> Gans Report, ¶ 627.

264. In 2016, a new version of header bidding (called “server-side header bidding”) emerged to address some of the challenges with client-side header bidding, such as latency.<sup>850</sup> While server-side header bidding did reduce the latency generated by client-side header bidding,<sup>851</sup> it still suffers from issues such as lack of auction transparency<sup>852</sup> and increased risk of inconsistent reporting and fraud.<sup>853</sup> Professor Gans also acknowledges the transparency issue associated with server-side header bidding, stating that “[i]nstead of residing on the publishers’ web pages, the code resides on the server, which executes the entire auction logic remotely and selects a winner. The tradeoff for solving the client-side wrapper issues, however, is that server-side solutions offer less transparency to publishers.”<sup>854</sup>

265. Companies that offer header bidding solutions today or have done so in the past include Amazon, Microsoft’s Xandr (formerly AppNexus), Index Exchange, OpenX, Rubicon Project, PubMatic, and Criteo.<sup>855</sup> Amazon Publisher Services (APS) also offers two main header bidding

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<sup>850</sup> Mike Sweeney, “5 Ad Tech & MarTech Trends for 2017: Industry Insiders Share Their Predictions,” *Clearcode*, December 12, 2023, available at <https://clearcode.cc/blog/5-ad-tech-martech-trends-for-2017/> (“2016 saw a number of companies move towards server-side header bidding as a way to reduce page latency caused by traditional browser-side (aka client-side) header bidding.”).

<sup>851</sup> Maciej Zawadziński, and Mike Sweeney, “What is Header Bidding and How Does it Work?” *Clearcode*, April 16, 2024, available at <https://clearcode.cc/blog/what-is-header-bidding/> (“The main advantage of server-side header bidding is a reduction in page latency. As all of the bidding happens outside of the browser in a dedicated server, the browser is able to render all the other parts of the page without being bogged down with multiple[] ad requests — resulting in a better user experience.”); “Introduction to Prebid,” *Prebid*, available at <https://docs.prebid.org/overview/intro.html> (“[...] [O]ur server solution can reduce latency and improve page load time. [...] When a publisher chooses to push auctions to the server side, they’re doing it to lighten the load that header bidding has on the browser. For instance, if five bidders are moved from the client side to the server side, the browser just makes one request to [Prebid Server], which delegates the actual auctions to the server, lightening the load on the user’s device.”).

<sup>852</sup> GOOG-DOJ-04387378 at 403; Maciej Zawadziński, and Mike Sweeney, “What is Header Bidding and How Does it Work?” *Clearcode*, April 16, 2024, available at <https://clearcode.cc/blog/what-is-header-bidding/>; Michal Wlosik, “Client-Side vs. Server-Side Header Bidding: Pros and Cons,” *Clearcode*, January 23, 2024, available at <https://clearcode.cc/blog/pros-cons-client-side-server-side-header-bidding/>.

<sup>853</sup> GOOG-DOJ-AT-00621267 at 267 (“Because header bidding transactions are recorded at different steps in the auction process, it is very difficult for a publisher to check if a sell-side platform participating in header bidding is paying the price they submit to the header bidding auction. This means for every non-verified bid, the publisher may not get paid, losing inventory and revenue.”); GOOG-DOJ-05310281 at 282 (“[P]oints about the potential drawbacks of header bidding: [...] publishers – open to fraud – unlike RTB, bidders don’t have to pay what they claim they’ll pay, no good way for publishers to monitor that per-query.”).

<sup>854</sup> Gans Report, ¶ 118.

<sup>855</sup> GOOG-DOJ-04387378 at 388.

solutions—Unified Ad Marketplace (UAM) and Transparent Ad Marketplace (TAM).<sup>856</sup> UAM and TAM are different in their contract structures and payment systems. In UAM, a publisher would sign a contract with Amazon (which would then sign contracts with ad exchanges) and receive combined monthly payments of earnings across all demand sources. In TAM, a publisher would sign a contract with each individual ad exchange and receive payments directly from each of them.<sup>857</sup> UAM is targeted towards small- to medium-sized publishers, while TAM is targeted towards large publishers with established direct relationships with ad exchanges.<sup>858</sup>

**J. In 2018, Google introduced Open Bidding to compete with header bidding.**

266. Following years of development, Google officially launched a new feature called Open Bidding in 2018 to compete with header bidding.<sup>859</sup> Open Bidding enabled participating third-party ad exchanges to compete with each other and with AdX in a real-time auction.<sup>860</sup> After

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<sup>856</sup> “Unified Ad Marketplace vs Transparent Ad Marketplace,” *Amazon Publisher Services*, available at <https://aps.amazon.com/aps/unified-ad-marketplace-uam-vs-transparent-ad-marketplace-tam/>; Anete Jodzevica, “A Guide to Amazon Publisher Services: UAM and TAM,” *Setupad Blog*, December 23, 2022, available at <https://setupad.com/blog/amazon-publisher-services-guide/>.

<sup>857</sup> “Unified Ad Marketplace vs Transparent Ad Marketplace,” *Amazon Publisher Services*, available at <https://aps.amazon.com/aps/unified-ad-marketplace-uam-vs-transparent-ad-marketplace-tam/>.

<sup>858</sup> Neeraja Shanker, “UAM vs TAM: Your manual to Amazon Publisher Services,” *Blockthrough*, April 5, 2022, available at <https://blockthrough.com/blog/uam-vs-tam-your-manual-to-amazon-publisher-services/>; Anete Jodzevica, “A Guide to Amazon Publisher Services: UAM and TAM,” *Setupad Blog*, December 23, 2022, available at <https://setupad.com/blog/amazon-publisher-services-guide/>.

<sup>859</sup> Jonathan Bellack, “Exchange Bidding now available to all customers using DoubleClick for Publishers,” *Google Ad Manager*, April 4, 2018, available at <https://blog.google/products/admanager/exchange-bidding-now-available-to-a/>. Open Bidding was a continuation of Google’s Demand Syndication and Exchange Bidding products, which were introduced around 2016. For simplicity, I will refer to all of these as “Open Bidding.” See GOOG-DOJ-11770230 at 230; GOOG-TEX-00118629 at 630 (“Demand Syndication is our answer to header bidding – a superior product for allowing pubs to get per-query bids from non-AdX exchanges[.]”); Jonathan Bellack, “Improving yield, speed and control with DoubleClick for Publishers First Look and exchange bidding,” *Google Ad Manager*, April 13, 2016, available at <https://www.blog.google/products/admanager/improving-yield-speed-and-control-with-dfp-first-look-and-exchange-bidding/>.

<sup>860</sup> GOOG-DOJ-11770230 at 233; Jonathan Bellack, “Improving yield, speed and control with DoubleClick for Publishers First Look and exchange bidding,” *Google Ad Manager*, April 13, 2016, available at <https://www.blog.google/products/admanager/improving-yield-speed-and-control-with-dfp-first-look-and-exchange-bidding/> (“Exchange bidding in Dynamic Allocation will allow publishers to invite trusted third-party exchanges and SSPs to submit real-time prices using industry-standard RTB calls. These prices will be considered along with bids from the DoubleClick Ad Exchange and the publisher’s reservation campaigns to pick the highest-paying ad.”); Jonathan Bellack, “Exchange Bidding now available to all customers using DoubleClick for Publishers,” *Google Ad Manager*, April 4, 2018, available at <https://blog.google/products/admanager/exchange-bidding-now-available-to-a/> (“With Exchange Bidding,

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Open Bidding launched, AdX buyers had no “last look” over the ad exchanges participating in Open Bidding.<sup>861</sup>

267. Open Bidding offered many of the benefits of header bidding, and it also provided significant improvements over header bidding’s operational issues.<sup>862</sup> Notably, Open Bidding reduced page latency compared to client-side header bidding,<sup>863</sup> provided publishers with transparency regarding the clearing price from each competing demand source in DFP,<sup>864</sup> and alleviated the billing discrepancies commonly observed under header bidding by acting as a clearinghouse where Google guaranteed payment.<sup>865</sup> These benefits offset the [REDACTED] fee that Google charged for use of Open Bidding,<sup>866</sup> given that these billing discrepancies often resulted in [REDACTED] less payment than expected.<sup>867</sup>

268. Header bidding remained popular after Google’s introduction of Open Bidding and remains popular today. Specifically, the adoption rate of header bidding among publishers

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publishers can increase revenue by allowing multiple exchanges to compete with each other – and with DoubleClick Ad Exchange – in a unified auction.”).

<sup>861</sup> In fact, AdX buyers had no “last look” even before Open Bidding was fully launched, as of March 2017. *See* GOOG-AT-MDL-008842393 at 401; GOOG-DOJ-13226855 at tab “Q1Q2 17 Launch News,” cell R60.

<sup>862</sup> Open Bidding alleviated many but not all of the issues with header bidding. For example, self-competition still persists in Open Bidding. *See* GOOG-DOJ-12947505 at 505 (“The risk of self-competition on Jedi inventories is less because we already remove last look (DBM bid via AdX will NOT be priced by DBM bid via external exchange). However, this is not true when DBM self-competes between header bidding and AdX (DBM bid via header bidding acts as pricing floor for AdX and DBM bid via AdX can be priced by DBM’s bid via header bidding).”).

<sup>863</sup> “Introduction to Open Bidding,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/7128453?hl=en> (“Open Bidding allows you to invite third-party demand partners to compete for your inventory in a single auction with real-time, server-to-server bidding.”); GOOG-TEX-00118629 at 639.

<sup>864</sup> GOOG-AT-MDL-007172126 (Deposition of [REDACTED], *In Re Google Antitrust Litigation*, November 6, 2020) at 294:22-295:3.

<sup>865</sup> GOOG-TEX-00118629 at 649; GOOG-DOJ-11770230 at 233 (“Exchange bidding ensures that exchanges must pay what they bid by giving publishers a single platform for unified and accurate reporting on the revenue they are earning from each exchange.”); GOOG-DOJ-10915097 at 100 (“Increased Transparency and Unified Payments will empower publishers by ensuring that exchanges must pay what they bid. And exchange bidding will provide publishers unified and accurate reporting on the revenue they are earning from each exchange/SSP. Pubs will get paid faster (net 30) and without the [REDACTED] discrepancies common today as serving + billing + reporting will all be on a single stack.”).

<sup>866</sup> GOOG-TEX-00118629 at 639 (chart showing the “Rev share” for “Demand Syndication” is [REDACTED]).

<sup>867</sup> GOOG-DOJ-10915097 at 100 (“Pubs will get paid [...] without the [REDACTED] discrepancies common today as serving + billing + reporting will all be on a single stack.”); GOOG-DOJ-15223226 at 240 (“There may be [...] significant discrepancies ([REDACTED]) between what buyers bid and what they pay[.]”).



remained high, ranging from 66% to 79% between 2018 and 2022.<sup>868</sup> Professor Gans notes from “[a] Google strategy document” that “the adoption of Header Bidding amongst publishers in North America grew from 50% in April 2016 to more than 75% in December 2018” and that “throughout 2017, third-party exchanges grew in volume in Header Bidding and Exchange Bidding.”<sup>869</sup> According to a 2019 research study by Roxot, the vast majority (94.5%) of publishers participating in the study reported using *both* AdX and client-side header bidding to sell their inventory.<sup>870</sup>

**K. In 2019, Google joined other ad exchanges in transitioning from a second-price auction to a first-price auction and modified Dynamic Allocation to end the so-called “last look.”**

269. Google’s ad exchange—like most ad exchanges using real-time bidding—initially functioned using a second-price auction,<sup>871</sup> where the highest bidder would win the auction but pay the amount of the *second-highest bid*.<sup>872</sup>

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<sup>868</sup> Ross Benes, “Five Charts: The State of Header Bidding,” *Insider Intelligence*, May 30, 2019, available at <https://www.insiderintelligence.com/content/five-charts-the-state-of-header-bidding> (measuring header bidding adoption during the 2018-2019 period as the percentage of the internet’s most popular 1,000 sites selling programmatic ads that used header bidding); GOOG-AT-DOJ-DATA-000066798 (Statista data measuring header bidding adoption by website type during the Q4 2020, Q1 2021, and Q1 2022 time period as the percentage of online publishing websites (top 100,000 websites) that used header bidding).

<sup>869</sup> Gans Report, ¶ 623 (citing GOOG-NE-04384116 at 120).

<sup>870</sup> “US Publisher Programmatic Revenues 2019,” *Roxot*, available at <https://roxot.com/report/sell-side-programmatic-us-2019>. Specifically, the research study is “based on the Roxot Prebid Analytics for Publishers and Roxot Revenue Lift data from more than 7 billion display ad auctions for the US users on both Desktop and Mobile devices collected from March 1st to May 31st, 2019.” Only publishers using “primary Google AdExchange account” were included in this study.

<sup>871</sup> Jason Bigler, “An update on first price auctions for Google Ad Manager,” *Google Ad Manager*, May 10, 2019, available at <https://blog.google/products/admanager/update-first-price-auctions-google-ad-manager/> (“Currently, Ad Manager may run two different auctions for a specific ad. A second price, real-time bidding auction run with Authorized Buyers – which includes Google Ads, Display & Video 360 and other Demand Side Platforms – followed by a first price auction that compares the winning price from the second price auction with a publisher’s guaranteed and non-guaranteed advertising campaigns, as well as bids from Exchange Bidding buyers.”); GOOG-DOJ-12038253 at 267 (demonstrating market shift away from second price auctions after 2017); Hana Choi, Carl F. Mela, Santiago R. Balseiro, and Adam Leary, “Online Display Advertising Markets: A Literature Review and Future Directions,” *Information Systems Research*, Vol. 31, No. 2, 2020, pp. 556-575 at 561.

<sup>872</sup> Maciej Zawadziński, and Mike Sweeney, “How Do First-Price and Second-Price Auctions Work in Online Advertising?” *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/first-price-second-price-auction/>.

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270. But in 2017, several ad exchanges, including AppNexus (now Microsoft’s Xandr), Index Exchange, OpenX, Rubicon Project, and PubMatic, began to replace second-price auctions with first-price auctions, where the winner would pay the amount of the *highest bid*.<sup>873</sup> A March 2018 analysis by Getintent (a DSP) found that 43.3% of the ad impressions that it analyzed were sold through first-price auctions, compared to 5.8% in December 2017.<sup>874</sup>

271. In March 2019, Google announced that it too would transition its ad exchange to a first price auction.<sup>875</sup> As part of that process, Google modified Dynamic Allocation to eliminate the possibility of non-guaranteed line items setting the AdX floor price, thereby ending any so-called “last look.”<sup>876</sup> As a result, by September 2019, Google allowed all sources of demand to compete simultaneously in a “Unified First-Price Auction” (UFPA) in which AdX buyers had no “last look” over third-party ad exchanges.<sup>877</sup>

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<sup>873</sup> Wei Zhang, Yanjun Han, Zhengyuan Zhou, Aaron Flores, and Tsachy Weissman, “Leveraging the Hints: Adaptive Bidding in Repeated First-Price Auctions,” *36th Conference on Neural Information Processing Systems (NeurIPS 2022)*, available at <https://openreview.net/pdf?id=hjqTeP05OMB>; Sarah Sluis, “Big Changes Coming To Auctions, As Exchanges Roll The Dice On First-Price,” *AdExchanger*, September 5, 2017, available at <https://www.adexchanger.com/platforms/big-changes-coming-auctions-exchanges-roll-dice-first-price/>; Maciej Zawadzinski, and Mike Sweeney, “How Do First-Price and Second-Price Auctions Work in Online Advertising?” *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/first-price-second-price-auction/>; Tom Kershaw, “Greater Transparency & Choice in Auction Dynamics,” *Rubicon Project*, December 11, 2017, available at <https://web.archive.org/web/20171212220711/https://rubiconproject.com/insights/thought-leadership/greater-transparency-choice-in-auction-dynamics/>; Kyle Dozeman, “First-Price Auctions: Reviving Control In Auction Dynamics,” *PubMatic*, February 1, 2018, available at <https://pubmatic.com/blog/first-price-auctions-auction-dynamics/>.

<sup>874</sup> Getintent analyzed 338 billion ad impressions across 39 SSPs in the U.S. in March 2018, and 171 billion ad impressions in December 2017. See Ross Benes, “First-Price Auctions Are Driving Up Ad Prices,” *Insider Intelligence*, October 17, 2018, available at <https://www.insiderintelligence.com/content/first-price-auctions-are-driving-up-ad-prices>; Getintent, “Empire State Bidding: RTB Auctions Research 2.0,” *Medium*, April 20, 2018, available at <https://blog.getintent.com/empire-state-bidding-rtb-auctions-research-2-0-17d72f35597>.

<sup>875</sup> Sam Cox, “Simplifying programmatic: first price auctions for Google Ad Manager,” *Google Ad Manager*, March 6, 2019, available at <https://www.blog.google/products/admanager/simplifying-programmatic-first-price-auctions-google-ad-manager/>.

<sup>876</sup> GOOG-DOJ-09714662 at 665 (“With the move to a unified 1st price auction, Ad Manager will not consider the price of competing non-guaranteed line items to calculate the reserve price.”). Note that Google publicly also refers to Enhanced Dynamic Allocation, which “allows all non-guaranteed demand—Open Auction, Open Bidding, and remnant line items—to compete in real time with guaranteed demand,” as “[d]ynamic allocation.” See “Delivery basics: Ad competition with dynamic allocation,” *Google Ad Manager Help*, available at <https://support.google.com/admanager/answer/3721872?hl=en>. Enhanced Dynamic Allocation remains in effect.

<sup>877</sup> GOOG-DOJ-09714662 at 663; GOOG-DOJ-09714662 at 665 (“With the move to a unified 1st price auction, Ad Manager will not consider the price of competing non-guaranteed line items to calculate the reserve price.”).



**L. In recent years, advertisers and publishers have used supply path optimization to increase efficiency by cutting steps in the ad tech chain.**

272. Efforts to continually increase efficiency and reduce costs in finding the optimal match between publishers and advertisers have triggered a push for *supply path optimization* (SPO), which seeks to improve results by eliminating the need for the entire chain of ad tech intermediaries (as described above) to be involved in every transaction.<sup>878</sup>

273. Advertisers use supply path optimization to focus on buying publisher inventory through the most efficient, scalable, and transparent supply paths, bypassing other intermediaries. For example, The Trade Desk, originally known as a DSP for advertisers, introduced a platform in 2022 that allows advertisers to purchase ad inventory directly from publishers without the use of ad exchanges.<sup>879</sup> This product, called OpenPath, removes SSPs from transactions.<sup>880</sup>

274. Supply path optimization seeks to increase advertisers' return on investment for their ad campaigns by promoting transparency in SSP fees and related costs, excluding known or suspected bad actors in the auction process,<sup>881</sup> and ensuring that ads appear in safe places, protecting advertisers' reputations.<sup>882</sup> And it appears to have worked: research finds that the untraceable portion of ad spending dropped from 15% to 3% between 2020 and 2022.<sup>883</sup> Another

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<sup>878</sup> Anthony Vargas, "AdExplainer: What Is Supply-Path Optimization (SPO)?" *AdExchanger*, April 25, 2022, available at <https://www.adexchanger.com/adexplainer/adexplainer-what-is-supply-path-optimization-spo/>.

<sup>879</sup> "OpenPath: Your pipeline to the open internet," *The Trade Desk*, available at <https://www.thetradedesk.com/us/our-platform/openpath>; Anthony Vargas, "Is The Trade Desk Encroaching On SSP Turf With OpenPath?" *AdExchanger*, March 3, 2022, available at <https://www.adexchanger.com/publishers/is-the-trade-desk-encroaching-on-ssp-turf-with-openpath/>.

<sup>880</sup> "OpenPath: Your pipeline to the open internet," *The Trade Desk*, available at <https://www.thetradedesk.com/us/our-platform/openpath>; Anthony Vargas, "Is The Trade Desk Encroaching On SSP Turf With OpenPath?" *AdExchanger*, March 3, 2022, available at <https://www.adexchanger.com/publishers/is-the-trade-desk-encroaching-on-ssp-turf-with-openpath/>.

<sup>881</sup> Jordan Linville, "What You Need To Know About Supply Path Optimization (SPO)," *PubMatic*, June 12, 2019, available at <https://pubmatic.com/blog/supply-path-optimization-tips/>; Graeme Lynch, "Why advertisers need to optimize their supply paths to prepare for 2023 and beyond," *Magnite*, March 14, 2023, available at <https://www.magnite.com/blog/why-advertisers-need-to-optimize-their-supply-paths-to-prepare-for-2023-and-beyond/>.

<sup>882</sup> Mike Sweeney, and Natalia Figas, "What Is Supply-Path Optimization?" *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/supply-path-optimization/>.

<sup>883</sup> Graeme Lynch, "Why advertisers need to optimize their supply paths to prepare for 2023 and beyond," *Magnite*, March 14, 2023, available at <https://www.magnite.com/blog/why-advertisers-need-to-optimize-their-supply-paths-to-prepare-for-2023-and-beyond/>.

study looking at supply path optimization showed that, when Samsung leveraged various optimization tools, the campaign resulted in a 98% ad quality score (confirmed impressions), compared to the benchmark of 70%, implying that impressions that failed to achieve an objective were reduced from 30% to 2%.<sup>884</sup>

275. One method of supply path optimization involves shifting more ad spending to programmatic direct deals—*i.e.*, direct deals between publishers and advertisers that are effectuated via ad tech. Through supply path optimization, advertisers can work strategically with publishers that have first-party data, curate their audiences, or provide improved contextual targeting.<sup>885</sup>

276. For example, in 2023, The Hershey Company, which spends hundreds of millions of dollars annually on advertising, decided to buy 80% of its advertising via private marketplaces and only 20% on open exchanges.<sup>886</sup> “[T]he company was tired of ads running too frequently, not showing up in premium environments and—worst of all—ending up adjacent to unsavory, long-tail publishers.”<sup>887</sup> And Omnicom Media Group—a large marketing holding company—recently stated, “There’s not a single major publisher that is doing programmatic that we don’t

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<sup>884</sup> ExchangeWire PressBox, “Xandr & Lucidity Provide New Advanced Path Optimisation for Samsung Electronics Benelux B.V.,” *ExchangeWire*, June 1, 2022, available at <https://www.exchangewire.com/blog/2022/06/01/xandr-lucidity-provide-new-advanced-path-optimisation-for-samsung-electronics-benelux-b-v/>.

<sup>885</sup> Graeme Lynch, “Why advertisers need to optimize their supply paths to prepare for 2023 and beyond,” *Magnite*, March 14, 2023, available at <https://www.magnite.com/blog/why-advertisers-need-to-optimize-their-supply-paths-to-prepare-for-2023-and-beyond/>; Ivan Guzenko, “Why The Line Between Buy-Side And Sell-Side Ad Tech Is Getting Blurred,” *Forbes*, September 25, 2023, available at <https://www.forbes.com/sites/forbestechcouncil/2023/09/25/why-the-line-between-buy-side-and-sell-side-ad-tech-is-getting-blurred/?sh=32eb072323fd> (“Obviously, the world’s movement toward transparency and privacy are the main drivers that push the ad tech market for alliances and convergence. [...] What does it mean for publishers and advertisers, and what exactly should they prepare for in order to thrive in this new normal? [...] Direct deals can be especially beneficial for publishers who have unique ad inventory.”).

<sup>886</sup> Catherine Perloff, “Direct Deals Grow for Marketers, but Won’t Solve All of Programmatic Ad Buying’s Ills,” *Adweek*, January 9, 2023, available at <https://www.adweek.com/programmatic/direct-deals-grow-for-marketers-but-wont-solve-all-of-programmatic-ad-buyings-ills/> (“The solution was to buy more media through programmatic, direct channels. The Hershey Company is working toward buying 80% of its addressable media via private marketplace deals and only 20% on the open exchange, a goal it plans to hit by the end of 2023[.]”).

<sup>887</sup> Catherine Perloff, “Direct Deals Grow for Marketers, but Won’t Solve All of Programmatic Ad Buying’s Ills,” *Adweek*, January 9, 2023, available at <https://www.adweek.com/programmatic/direct-deals-grow-for-marketers-but-wont-solve-all-of-programmatic-ad-buyings-ills/>.

have private marketplaces [a form of programmatic direct deal] set up with within the top 100.”<sup>888</sup>

277. Publishers likewise can use supply path optimization to bypass one or more intermediaries. For example, PubMatic, which was traditionally an SSP focused on publishers, launched a platform in 2023 that allows advertisers and ad agencies to buy connected TV and video ad inventory from publishers via direct deals.<sup>889</sup> PubMatic described the new feature—known as Activate—as giving buyers the ability to “log in directly to the SSP and book their ad campaigns, a contrast to the more orthodox method of programmatic media buying via DSPs.”<sup>890</sup> Claimed benefits of Activate include added pricing transparency and reduced complexity of programmatic ad selling and buying for publishers and advertisers.<sup>891</sup>

278. As one article from 2018 pointed out, “Publishers that proactively lean into SPO [(supply path optimization)] will benefit by ensuring that their buyers know exactly where to connect with them, with each arriving at the best outcome. SPO is pushing our industry toward fee transparency and clean auction dynamics, both of which agencies and brands have been seeking for years.”<sup>892</sup> With SPO, publishers that offer premium inventory will receive more direct and inexpensive paths to advertisers.<sup>893</sup> As a result, quality-focused publishers will earn more, while

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<sup>888</sup> Michael Bürgi, “Media Buying Briefing: Debating the value of open-exchange programmatic vs. PMPs,” *Digiday*, June 12, 2023, available at <https://digiday.com/media-buying/media-buying-briefing-debating-the-value-of-open-exchange-programmatic-vs-pmps/>.

<sup>889</sup> Ronan Shields, “PubMatic debuts Activate, as the line between demand- and sell-side players continues to blur,” *Digiday*, May 8, 2023, available at <https://digiday.com/media/pubmatic-debuts-activate-as-the-line-between-demand-and-sell-side-players-continues-to-blur/>; “PubMatic to Acquire Martin to Further Accelerate Supply Path Optimization Product Innovation,” *PubMatic*, September 14, 2022, available at <https://pubmatic.com/news/pubmatic-to-acquire-martin-to-further-accelerate-supply-path-optimization-product-innovation/>.

<sup>890</sup> Ronan Shields, “PubMatic debuts Activate, as the line between demand- and sell-side players continues to blur,” *Digiday*, May 8, 2023, available at <https://digiday.com/media/pubmatic-debuts-activate-as-the-line-between-demand-and-sell-side-players-continues-to-blur/>.

<sup>891</sup> Ronan Shields, “PubMatic debuts Activate, as the line between demand- and sell-side players continues to blur,” *Digiday*, May 8, 2023, available at <https://digiday.com/media/pubmatic-debuts-activate-as-the-line-between-demand-and-sell-side-players-continues-to-blur/>.

<sup>892</sup> Erik Requidan, “The Mainstreaming Of Supply-Path Optimization,” *AdExchanger*, October 12, 2018, available at <https://www.adexchanger.com/the-sell-sider/the-mainstreaming-of-supply-path-optimization/>.

<sup>893</sup> Mike Sweeney, and Natalia Figas, “What Is Supply-Path Optimization?” *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/supply-path-optimization/>.

low-quality ones will either improve quality or lose share, for the benefit of the ad-supported ecosystem as a whole.<sup>894</sup>

**M. Ad tech companies continue to expand their offerings, including by providing more integrated solutions to match publishers and advertisers to improve efficiency.**

279. Over the last decade, ad tech companies have introduced increasingly consolidated solutions that integrate different functions to improve aspects of the buying and selling process.<sup>895</sup> As described below, these have included consolidated sell-side products as well as integration across the whole of the ad tech stack.

280. The functions of an ad exchange and an SSP have now largely been merged into the same service offering.<sup>896</sup> Similarly, some publisher ad servers have been integrated with SSPs and ad exchanges.<sup>897</sup> Some ad networks have also incorporated ad serving functionalities.<sup>898</sup> Advantages of integration include allowing publishers to manage and sell their inventory on a single

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<sup>894</sup> Mike Sweeney, and Natalia Figas, “What Is Supply-Path Optimization?” *Clearcode*, May 15, 2024, available at <https://clearcode.cc/blog/supply-path-optimization/>.

<sup>895</sup> Matthew Papa, “Brace Yourselves. More Consolidation Is Coming,” *AdExchanger*, October 28, 2022, available at <https://www.adexchanger.com/data-driven-thinking/brace-yourselves-more-consolidation-is-coming/>; Rupert Graves, “End-to-End vs Pure-Play Ad Platforms,” *Medium*, July 30, 2016, available at <https://medium.com/@rupert.graves/end-to-end-vs-pure-play-ad-platforms-71c3b92a3086>.

<sup>896</sup> Playwire Technical Team, “The Best Ad Exchanges for Publishers in 2024,” *Playwire*, available at <https://www.playwire.com/blog/best-ad-exchanges-for-publishers>; Paulina Zawiślak, and Mike Sweeney, “Top Supply-Side Platform (SSP) and Ad Exchange Companies [Updated in 2024],” *Clearcode*, January 25, 2024, available at <https://clearcode.cc/blog/ssp-and-ad-exchange-companies/> (“Ad exchanges were once standalone platforms, and many still are today, but over the past few years many AdTech companies have incorporated ad exchange functionality into their SSPs, and vice versa.”). Professor Gans also acknowledges that “‘Ad exchange’ and ‘SSPs’ are often used interchangeably.” See Gans Report, Footnote 425.

<sup>897</sup> Playwire Technical Team, “The Best Ad Exchanges for Publishers in 2024,” *Playwire*, available at <https://www.playwire.com/blog/best-ad-exchanges-for-publishers>.

<sup>898</sup> “Native Ad Server: The Industry’s Only End-to-End Native Ad Server,” *Outbrain*, available at <https://www.outbrain.com/publishers/native-ad-server/> (“The only end-to-end platform to manage serving and selling built for native advertising.”); “Glossary: Facebook Audience Network,” *Lunio*, available at <https://lunio.ai/glossary/facebook-audience-network/> (“When a user visits a participating app or website, the Facebook Audience Network software will use this information to serve an ad that is relevant to the user.”).

platform, use data analytics and performance metrics to improve monetization, and better control the quality of ads matched with their available ad slots.<sup>899</sup>

281. Ad tech companies with integrated sell-side operations (SSP/ad exchange and publisher ad server) include Microsoft (Xandr),<sup>900</sup> FreeWheel,<sup>901</sup> Magnite,<sup>902</sup> and Equativ<sup>903</sup> among others. These ad tech companies with integrated sell-side operations were formed through mergers of formerly independent companies. For example, AT&T launched its ad tech unit, Xandr, in 2018, “combining its data and analytics business with technologies from its acquisition of digital and TV ad marketplace AppNexus,” a multinational technology company operating a cloud-based

<sup>899</sup> Paulina Zawiślak, and Mike Sweeney, “Top Supply-Side Platform (SSP) and Ad Exchange Companies [Updated in 2024],” *Clearcode*, January 25, 2024, available at <https://clearcode.cc/blog/ssp-and-ad-exchange-companies/> (“Ad exchanges were once standalone platforms, and many still are today, but over the past few years many AdTech companies have incorporated ad exchange functionality into their SSPs, and vice versa. This allows publishers to manage their inventory and sell it via RTB from one platform.”); Maciej Zawadziński, and Mike Sweeney, “What is an Ad Server and How Does It Work?” *Clearcode*, May 20, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-server/> (“Some of the functionalities that were added to ad servers with time, like targeting, budget control, and frequency capping, have also been incorporated into many of the newer platforms, such as DSPs and SSPs.”).

<sup>900</sup> “Microsoft Monetize SSP,” *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en/solutions/technology/microsoft-monetize/monetize-ssp> (“Comprehensive solutions for holistic inventory and demand channel management needed to strategically grow your business.” “Access a diverse marketplace with demand sourced from proprietary Microsoft buying platforms and trusted demand partners.” “Topline revenue insights and granular in-depth reports for informed analysis, troubleshooting, and action.”).

<sup>901</sup> Alyssa Boyle, “Havas Media Names FreeWheel A Preferred SSP,” *AdExchanger*, February 1, 2023, available at <https://www.adexchanger.com/digital-tv/havas-media-names-freewheel-a-preferred-ssp/> (discussing Havas Media’s decision to use FreeWheel as its preferred SSP because “its ad server is integrated with its SSP”).

<sup>902</sup> Magnite, founded in 2020, offers ad tech products/services a supply-side platform, an ad server and header bidding software. See “Meet Magnite, the Largest Independent Omnichannel Sell-Side Platform in the World,” *Magnite*, June 30, 2020, available at <https://investor.magnite.com/news-releases/news-release-details/meet-magnite-largest-independent-omnichannel-sell-side-platform>; “You work hard to build your audience. Together, we’ll make every impression count.” *Magnite*, available at <https://www.magnite.com/sellers/> (“Fast-forward your CTV and OTT business with our award-winning Supply-Side Platform and ad server. They’re great on their own, and even better together.”); “Ad Tech Ecosystem: Magnite,” *Playwire*, available at <https://www.playwire.com/ad-tech-ecosystem/magnite>. It is the world’s largest independent sell-side advertising company and had a revenue of \$577 million in 2022. See Statista Research Department, “Revenue generated by Magnite, Inc. from 2016 to 2023,” *Statista*, March 15, 2023, available at <https://www.statista.com/statistics/1232100/magnite-revenue/>. It has diverse clients such as eBay, Spotify, Warner Bros. Discovery, and Yahoo. See “Helping you win across every screen, everywhere.” *Magnite*, available at <https://www.magnite.com/>.

<sup>903</sup> [REDACTED]  
[REDACTED] “SSP Marketplace,” *Equativ*, available at <https://equativ.com/solutions/earn/ssp/>.

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software platform that enables and optimizes programmatic online advertising.<sup>904</sup> Then in December 2021, Microsoft acquired Xandr,<sup>905</sup> creating an ad tech stack that provides both sell-side and buy-side services. In 2014, Comcast acquired FreeWheel, one of the largest platforms used by TV networks and major video distributors.<sup>906</sup> Magnite was also formed through the 2020 merger of Rubicon Project and Telaria (formerly Tremor Video's SSP) and created the largest independent omnichannel sell-side platform (SSP and ad exchange).<sup>907</sup> Thus, while Dr. Chandler portrays Google as an outlier in making acquisitions in the ad tech industry, mergers and acquisitions among ad tech players are in fact common.<sup>908</sup>

282. Similar to the integration that occurred after the mergers discussed above, in June 2018, Google integrated the functionalities of its ad exchange (AdX) and its publisher ad server (DFP) and rebranded the resulting product as Google Ad Manager (GAM).<sup>909</sup> GAM is a single platform that can be used to sell display ad inventory on websites, mobile apps, video platforms like YouTube, and devices like CTV.<sup>910</sup> It was designed to help publishers "maximize yield across

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<sup>904</sup> Todd Bishop, "Microsoft to acquire AT&T's Xandr advertising tech business, gearing up for a 'post-cookie world,'" *GeekWire*, December 21, 2021, available at <https://www.geekwire.com/2021/microsoft-to-acquire-atts-xandr-advertising-tech-business-gearing-up-for-a-post-cookie-world/>; Rebecca Stewart, "AT&T buys AppNexus as it looks to bulk up its adtech business," *The Drum*, June 25, 2018, available at <https://www.thedrum.com/news/2018/06/25/att-buys-appnexus-it-looks-bulk-up-its-adtech-business>; Stephanie Clifford, "Instant Ads Set the Pace on the Web," *The New York Times*, March 11, 2010, available at <https://www.nytimes.com/2010/03/12/business/media/12adco.html>.

<sup>905</sup> "AT&T Has Agreed to Sell Xandr to Microsoft," *AT&T*, December 21, 2021, available at <https://about.att.com/story/2021/xandr.html>.

<sup>906</sup> Ryan Lawler, "Comcast Is Acquiring Video Ad Company FreeWheel For \$320 Million," *TechCrunch*, March 1, 2014, available at <https://techcrunch.com/2014/03/01/comcast-freewheel/>.

<sup>907</sup> Daniel Sparks, "Rubicon Project and Telaria Combine, Forming the Largest Independent Sell-Side Ad Tech Company," *The Motley Fool*, April 1, 2020, available at <https://www.fool.com/investing/2020/04/01/rubicon-project-telaria-combine-forming-largest-in.aspx>.

<sup>908</sup> Chandler Report, ¶ 197.

<sup>909</sup> Jonathan Bellack, "Introducing Google Ad Manager," *Google Ad Manager*, June 27, 2018, available at <https://blog.google/products/admanager/introducing-google-ad-manager/>; Sridhar Ramaswamy, "Introducing simpler brands and solutions for advertisers and publishers," *Google The Keyword*, June 27, 2018, available at <https://www.blog.google/technology/ads/new-advertising-brands/>. Google had been working towards this unification for three years before the announcement. See Jonathan Bellack, "Introducing Google Ad Manager," *Google Ad Manager*, June 27, 2018, available at <https://blog.google/products/admanager/introducing-google-ad-manager/>; Sarah Sluis, "DoubleClick No More! Google Renames Its Ad Stack," *AdExchanger*, June 27, 2018, available at <https://www.adexchanger.com/platforms/doubleclick-no-more-google-renames-its-ad-stack/>.

<sup>910</sup> Jonathan Bellack, "Introducing Google Ad Manager," *Google Ad Manager*, June 27, 2018, available at <https://blog.google/products/admanager/introducing-google-ad-manager/>; Sridhar Ramaswamy, "Introducing simpler brands and solutions for advertisers and publishers," *Google The Keyword*, June 27, 2018, available at <https://www.blog.google/technology/ads/new-advertising-brands/>.



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reservations, private marketplaces, and the open auction.”<sup>911</sup> There was also an emphasis on spam detection and protection from malware and domain spoofing in GAM.<sup>912</sup>

283. Like Google, many ad tech providers have integrated *across* the sell-side and buy-side of ad tech as well, to provide greater efficiency and transparency for buying and selling ads. For example, Criteo provides an ad exchange/SSP and a DSP.<sup>913</sup> As discussed above, Xandr (formerly AppNexus, now owned by Microsoft) has its own publisher ad server, ad exchange/SSP, and DSP.<sup>914</sup> Amazon offers supply-side solutions and a DSP, which it created in part through acquisitions, including its acquisition of Sizmek’s ad server in 2019.<sup>915</sup> Comcast offers an ad server integrated with an SSP and a DSP through its acquisition of FreeWheel in 2014 (discussed above), and FreeWheel’s 2020 acquisition of Beeswax (a DSP).<sup>916</sup> Nexxen is an

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<sup>911</sup> Jonathan Bellack, “Introducing Google Ad Manager,” *Google Ad Manager*, June 27, 2018, available at <https://blog.google/products/admanager/introducing-google-ad-manager/>.

<sup>912</sup> Jonathan Bellack, “Introducing Google Ad Manager,” *Google Ad Manager*, June 27, 2018, available at <https://blog.google/products/admanager/introducing-google-ad-manager/>.

<sup>913</sup> “Glossary Of Terms: Digital Advertising, A-to-Z,” *Criteo*, available at <https://www.criteo.com/digital-advertising-glossary/> (see “Criteo Exchange,” “Criteo SSP,” and “Criteo DSP”).

The CEO of Criteo has also stated that “the company [...] views itself as a hybrid DSP-SSP.” See James Hercher, “Criteo Sees Ad Revenue Rebound, And Reshapes Its Pitch As A DSP And SSP Hybrid,” *AdExchanger*, August 4, 2021, available at <https://www.adexchanger.com/online-advertising/criteo-sees-ad-revenue-rebound-and-reshapes-its-pitch-as-a-dsp-and-ssp-hybrid/>.

<sup>914</sup> James Hercher, “Xandr, Formerly AppNexus, Is Now Formerly AT&T, After Its Acquisition By Microsoft,” *AdExchanger*, December 21, 2021, available at <https://www.adexchanger.com/online-advertising/xandr-formerly-appnexus-is-now-formerly-att-after-its-acquisition-by-microsoft/>; “Microsoft Monetize SSP,” *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en/solutions/technology/microsoft-monetize/monetize-ssp> (“Comprehensive solutions for holistic inventory and demand channel management needed to strategically grow your business.” “Access a diverse marketplace with demand sourced from proprietary Microsoft buying platforms and trusted demand partners.” “Topline revenue insights and granular in-depth reports for informed analysis, troubleshooting, and action.”); “Microsoft Invest,” *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en-us/solutions/xandr/xandr-premium-programmatic-advertising> (“Microsoft Invest is a demand-side platform built for the future of video advertising. With an integrated platform advantage and a focus on data-driven performance, Invest enables you to engage audiences on all screens and drive business results.”); Stephen Graveman, “What Is an SSP? Supply Side Platform Advertising Explained,” *MNTN*, available at <https://mountain.com/blog/what-is-an-ssp-supply-side-platform-advertising-explained/>.

<sup>915</sup> “Introducing Amazon Publisher Cloud,” *Amazon Publisher Services*, available at <https://aps.amazon.com/aps/index.html>; “Amazon DSP: Your brand in new places.” *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/amazon-dsp>; “Amazon Ad Server,” *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/sizmek-ad-suite>.

<sup>916</sup> “About Us,” *FreeWheel*, available at <https://www.freewheel.com/about>; Alyssa Boyle, “Havas Media Names FreeWheel A Preferred SSP,” *AdExchanger*, February 1, 2023, available at <https://www.adexchanger.com/digital-tv/havas-media-names-freewheel-a-preferred-ssp/> (“FreeWheel stood out

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integrated DSP, SSP, CTV ad server, and data management platform.<sup>917</sup> Rubicon Project, founded as an SSP in 2007, acquired multiple companies in order to streamline and integrate its services provided to publishers.<sup>918</sup> In 2009, Rubicon acquired Fox Audience Network, including its ad buying platform, its publisher ad server, and its targeting and analytics technologies.<sup>919</sup> In April 2021, Rubicon Project merged with Telaria (an SSP)<sup>920</sup> to form Magnite, which started to provide services across the buy- and sell-side of display advertising in 2023.<sup>921</sup> In 2013, X (formerly Twitter) acquired MoPub, a mobile ad network, ad server, and real-time bidding exchange, to help mobile publishers manage their ad inventory.<sup>922</sup> X also acquired CrossInstall (a

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this time because its ad server is integrated with its SSP[.]”); “About Us: FreeWheel’s Beeswax Platform,” *Beeswax*, available at <https://www.beeswax.com/about/>.

<sup>917</sup> “Tremor International Group Rebrands as Nexxen,” *Nexxen*, June 12, 2023, available at <https://investors.tremorinternational.com/news-releases/news-release-details/tremor-international-group-rebrands-nexxen-0>; “One platform. Endless opportunities.” *Nexxen*, available at <https://www.nexxen.com/>; “We help you reach your consumers & maximize your ROI,” *Nexxen*, available at <https://www.nexxen.com/advertisers>; “Working Harder, So Your Digital & CTV Inventory Can Work Hardest,” *Nexxen*, available at <https://www.nexxen.com/broadcasters-publishers>.

<sup>918</sup> “The Evolution Of The Supply Side Platform,” *Sharethrough*, December 14, 2015, available at <https://www.sharethrough.com/blog/the-evolution-of-the-supply-side-platform> (“The original supply side platforms Admeld (founded 2007), Rubicon Project (founded 2007) and PubMatic (founded 2006) first gained steam with publishers through ad network optimization.”); Tom Dotan, “Rubicon Project Files for \$100 Million Public Offering,” *Los Angeles Business Journal*, February 4, 2014, available at <https://labusinessjournal.com/news/2014/feb/04/rubicon-files-100-million-public-offering/>.

<sup>919</sup> “the Rubicon Project Acquires Fox Audience Network (FAN) for Technology Assets and Team,” *Ad Tech Daily*, November 1, 2010, available at <https://adtechdaily.com/2010/11/01/the-rubicon-project-acquires-fox-audience-network-fan-for-technology-assets-and-team/>.

<sup>920</sup> Barry Levine, “Telaria launches ‘first complete video ad platform’ for OTT,” *MarTech*, May 24, 2018, available at <https://martech.org/telaria-launches-first-complete-video-ad-platform-for-ott/> (“Video supply-side platform Telaria has launched what it says is the ‘first complete video ad management platform’ for over-the-top (OTT) TV.”).

<sup>921</sup> “Rubicon Project and Telaria Complete Merger Following Stockholder Approvals,” *Business Wire*, April 1, 2020, available at <https://www.businesswire.com/news/home/20200401005185/en/Rubicon-Project-and-Telaria-Complete-Merger-Following-Stockholder-Approvals>; “Meet Magnite, the Largest Independent Omnichannel Sell-Side Platform in the World,” *Magnite*, June 30, 2020, available at <https://investor.magnite.com/news-releases/news-release-details/meet-magnite-largest-independent-omnichannel-sell-side-platform>; Hana Yoo, “Magnite Cuts Out DSPs With Direct-Buy Video Platform for CTV,” *AdExchanger*, April 17, 2023, available at <https://www.adexchanger.com/ad-exchange-news/magnite-cuts-out-dsps-with-direct-buy-video-platform-for-ctv/>.

<sup>922</sup> Jim Edwards, “Twitter Acquires MoPub for \$350 Million In Order To Build A Mobile Ad Exchange,” *Business Insider*, September 9, 2013, available at <https://www.businessinsider.com/twitter-acquires-mobile-ad-network-mopub-for-350-million-will-an-ad-exchange-come-next-2013-9>.



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mobile DSP) in 2020.<sup>923</sup> Adobe created an integrated ad stack through acquisitions and building out capabilities through integrations with the Adobe Marketing Cloud.<sup>924</sup> In 2011, Adobe acquired the Demdex data management platform. In 2012, Adobe acquired Efficient Frontier, a cross channel (search, social, display) programmatic ad buying, management and optimization platform.<sup>925</sup> TubeMogul, a DSP, was acquired by Adobe in 2016 in order to add a video component to its existing Adobe Marketing Cloud DSP, which covered search, display, and social advertising.<sup>926</sup> The goal was to create an end-to-end video advertising platform, where “first-party data and measurement from [Adobe] Audience Manager and Adobe Analytics is available directly in TubeMogul’s platform.”<sup>927</sup>

284. Thus, while Dr. Chandler claims that vertical integration creates conflicts of interest,<sup>928</sup> Google is hardly an outlier in seeking the benefits of integration, with several players in the industry offering multiple products to enable various levels of integration in their ad tech stack. Plaintiffs’ experts have not provided any basis to support their position that these commonplace industry-level tactics are problematic.

285. In addition, publishers, such as news media companies, have become more deeply engaged in the rapidly changing digital space and have expanded their offerings to bring ad tech solutions in-house. In the late 2010s, certain news publications moved their ad servers and data management tools in-house to enhance data control, improve ad targeting, and increase overall advertising efficiency.

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<sup>923</sup> Allison Schiff, “Twitter Acquires Mobile DSP CrossInstall on the Hunt for Mobile Performance Dollars,” *AdExchanger*, May 12, 2020, available at <https://www.adexchanger.com/platforms/twitter-acquires-mobile-dsp-crossinstall-on-the-hunt-for-mobile-performance-dollars/>.

<sup>924</sup> Pete Kluge, “The Journey into AdTech,” *Adobe Blog*, November 16, 2015, available at <https://blog.adobe.com/en/publish/2015/11/16/the-journey-into-adtech>.

<sup>925</sup> Pete Kluge, “The Journey into AdTech,” *Adobe Blog*, November 16, 2015, available at <https://blog.adobe.com/en/publish/2015/11/16/the-journey-into-adtech>.

<sup>926</sup> Anthony Ha, “Adobe acquires video ad company tuboMogul for \$540M,” *TechCrunch*, November 10, 2016, available at <https://techcrunch.com/2016/11/10/adobe-acquires-tubemogul/>; “Adobe Completes Acquisition of TubeMogul,” *Adobe*, December 19, 2016, available at <https://news.adobe.com/news/news-details/2016/Adobe-Completes-Acquisition-of-TubeMogul/default.aspx>.

<sup>927</sup> Lara O’Reilly, “Adobe is acquiring ad tech company TubeMogul for \$540 million,” *Business Insider*, November 10, 2016, available at <https://www.businessinsider.com/adobe-is-acquiring-ad-tech-tubemogul-for-450-million-2016-11>.

<sup>928</sup> Chandler Report, ¶¶ 195-196.

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286. For example, by 2017, The Washington Post operated a dozen products, including a proprietary content management system (CMS) and software-as-a-service (SaaS) offered to other publishers.<sup>929</sup> In 2019, The Washington Post introduced new ad targeting technology, and later in the same year, it launched an ad buying user interface that enables advertisers to purchase premium ad inventory directly from The Washington Post in real time, in an automated manner.<sup>930, 931</sup>

287. From 2018 to 2019, The New York Times transitioned a portion of its “ad rendering logic” to an internal solution and built machine learning models that enabled advertisers to target ads based on real-time data associated with The New York Times’s articles.<sup>932</sup> Since then, The New York Times has continued to use data (including its rich first-party data about readers) to improve its direct-sold ads business through the application of data science techniques and machine learning models.<sup>933</sup> In 2022, Vox Media launched Concert SSP, an in-house supply-side

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<sup>929</sup> Jessica Goodfellow, “How Jeff Bezos built a tech business within the Washington Post,” *The Drum*, November 8, 2017, available at <https://www.thedrum.com/news/2017/11/08/how-jeff-bezos-built-tech-business-within-the-washington-post>.

<sup>930</sup> The technology would help advertisers reach their desired audience by tracking “patterns of reader consumption of Post content and aggregating that data to predict future behavior[.]” See WashPostPR, “The Washington Post introduces next generation targeting for marketers; laying groundwork for secure, cookie-free ad experiences,” *The Washington Post*, July 16, 2019, available at <https://www.washingtonpost.com/pr/2019/07/16/washington-post-introduces-next-generation-targeting-marketers-laying-groundwork-secure-cookie-free-ad-experiences/>.

<sup>931</sup> WashPostPR, “The Washington Post launches Zeus Prime, creating a premium network for brands and publishers,” *The Washington Post*, September 17, 2019, available at <https://www.washingtonpost.com/pr/2019/09/17/washington-post-launches-zeus-prime-creating-premium-network-brands-publisher/>. While initially limited to Washington-based advertisers on The Washington Post, in 2021, the Post expanded the scope of participants and announced that this ad network would be open to other participating partners. See WashPostPR, “The Washington Post debuts Zeus Prime premium ad network,” *The Washington Post*, September 21, 2021, available at <https://www.washingtonpost.com/pr/2021/09/21/washington-post-debuts-zeus-prime-premium-ad-network/>.

<sup>932</sup> Edgar Velez, and Pranay Prabhat, “Faster and Lighter: Moving Ad Tech Server-Side,” *Medium*, January 24, 2019, available at <https://open.nytimes.com/faster-and-lighter-moving-ad-tech-server-side-cf4bd6d2f2eb>.

<sup>933</sup> Pranay Prabhat, “To Serve Better Ads, We Built Our Own Data Program,” *Medium*, December 17, 2020, available at <https://open.nytimes.com/to-serve-better-ads-we-built-our-own-data-program-c5e039bf247b>;

[REDACTED]

platform that enabled advertisers to access Vox’s inventory and monetization technology, along with inventory of other participating publishers (mostly news companies).<sup>934</sup>

**VIII. PLAINTIFFS’ EXPERTS’ NARROW VIEW OF “DISPLAY ADVERTISING” AND INCOMPLETE PERSPECTIVE ON AD TECH IMPROPERLY DISCOUNT THE VARIETY OF PATHWAYS ADVERTISERS HAVE AVAILABLE TO CONNECT WITH PUBLISHERS.**

288. As described throughout this report, Plaintiffs’ experts ignore many of the options available to advertisers, as well as many of the paths and technologies through which online display advertising can be purchased and sold and how those have evolved over time.

289. While not evident from Plaintiffs’ expert reports, over the last nearly three decades, ad tech has evolved (and continues to evolve) to improve matches between publishers seeking to sell inventory and advertisers seeking to buy inventory. The industry has moved from one limited to simple direct deals conducted manually between advertisers and publishers in the 1990s, to now predominantly involve programmatic transactions<sup>935</sup> occurring in real time, on a per-impression basis, through technologies provided by many different, and increasingly integrated, entities, and frequently occurring on the publishers’ very own platforms.

290. Moreover, by excluding the increasing number of sources from which advertisers can purchase display ad inventory and the industry-wide phenomenon of increasing integration in the ad tech stack, Plaintiffs’ experts give a misleading impression of a static industry with artificial

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<sup>934</sup> “Retailer Ad Platforms Integrate The Web; Vox Media Enters The SSP Biz,” *AdExchanger*, June 8, 2022, available at <https://www.adexchanger.com/ad-exchange-news/wednesday-08062022/>;

[REDACTED]

<sup>935</sup> See **Section VII**; see also Mike Sweeney, “What is Programmatic Advertising? The Definitive Guide for 2024,” *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/programmatic-advertising/> (“Programmatic advertising is defined as the process of automating the purchase, sale, delivery, and measurement of digital advertising campaigns via advertising technology (AdTech) platforms. These AdTech platforms allow advertisers, publishers, and agencies to create, run, and optimize ad campaigns with minimal human involvement.”).

distinctions between types of display ads and between ad tech products that do not accurately reflect the dynamism and innovation in the real world.

291. Contrary to the picture painted by Plaintiffs’ experts,<sup>936</sup> display ads can be transacted through many pathways and tools. Notably, Plaintiffs and their experts ignore display ad dollars that run through certain pathways, such as publishers’ self-service platforms.<sup>937</sup> In doing so, Plaintiffs ignore years of evolution in ad tech that has enabled publishers and advertisers to select several permutations of direct or indirect display ad transactions, involving one or more internally developed or externally sourced ad tech tools. Some of the configurations are primarily or exclusively used for direct display ad transactions; others can facilitate both direct and indirect display ad transactions. I summarize nine different pathways in **Table 2**.

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<sup>936</sup> For example, Dr. Chandler categorizes display ad sales into four categories, where he makes distinctions between “direct vs. indirect sales” and “programmatic vs. non-programmatic methods.” See Chandler Report, ¶ 107. Professor Gans acknowledges that “[b]oth programmatic direct and indirect deals are transacted through ad exchanges,” but he contends that “[d]irect transactions are not in the relevant product market for indirect open web display advertising ad exchange.” See Gans Report, ¶ 200.

<sup>937</sup> As shown in **Figure 10**, **Figure 15**, and **Figure 17**, ad spending on social media, retail media, and connected TV accounts for 49%, 10%, and 16% of the total display ad spending in the U.S. in 2023, respectively. These figures include ad spending on publishers’ self-service platforms as well as through their ad tech products (such as ad networks or DSPs).

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**Table 2. Examples of Different Pathways of Display Ad Transactions**

<b>1</b>	<b>Advertiser</b>	Self-Service Platform*			<b>Publisher</b>
<b>2</b>	<b>Advertiser</b>	Publisher Ad Server [ <i>Direct Deals</i> ]**			<b>Publisher</b>
<b>3</b>	<b>Advertiser</b>	Ad Network*			<b>Publisher</b>
<b>4</b>	<b>Advertiser</b>	Ad Network		Publisher Ad Server	<b>Publisher</b>
<b>5</b>	<b>Advertiser</b>	DSP / Ad Network	Ad Exchange / SSP	Publisher Ad Server	<b>Publisher</b>
<b>6</b>	<b>Advertiser</b>	DSP / Ad Network	Ad Exchange / SSP through Header Bidding	Publisher Ad Server	<b>Publisher</b>
<b>7</b>	<b>Advertiser</b>	DSP / Ad Network	Ad Exchange / SSP*		<b>Publisher</b>
<b>8</b>	<b>Advertiser</b>	Supply Path Optimization with Ad Exchange / SSP		Publisher Ad Server	<b>Publisher</b>
<b>9</b>	<b>Advertiser</b>	Supply Path Optimization with DSP		Publisher Ad Server	<b>Publisher</b>

\* In the case of this transaction path, this tool would also perform the ad serving function.

\*\* In some cases, this path can also involve negotiation that takes place via a DSP and SSP.

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292. **Path 1** represents self-service platforms, which are in-house ad tech tools that allow advertisers to buy impressions directly from publishers running owned-and-operated platforms. Self-service platforms typically include a buying interface through which advertisers place ads directly on the publisher's owned-and-operated inventory, without any ad tech intermediary.<sup>938</sup> Examples of self-service platforms include Meta Ads Manager (which is used to purchase advertising on Facebook and Instagram),<sup>939</sup> TikTok Ads Manager,<sup>940</sup> X Ads Manager,<sup>941</sup> Snapchat Ads Manager,<sup>942</sup> Amazon Ads,<sup>943</sup> Google Ads (to the extent it is used to purchase inventory on Google's owned-and-operated properties, such as YouTube),<sup>944</sup> Microsoft

<sup>938</sup> Philip Mahler, "Internet Walled Gardens: What It Means For Advertisers?" *Eskimi*, January 12, 2024, available at <https://www.eskimi.com/blog/internet-walled-gardens> ("While most publishers in the open internet use ad exchanges and networks to monetize their websites, walled gardens sell ad placements to advertisers directly.").

<sup>939</sup> "View and analyze ads results in Meta Ads Manager," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/318580098318734>; "Facebook Attribution: A Measurement Tool for Today's Digital Advertising Landscape," *Facebook Business*, October 19, 2018, available at <https://www.facebook.com/business/news/facebook-attribution-a-measurement-tool-for-todays-digital-advertising-landscape>; [REDACTED]

<sup>940</sup> "TikTok For Business Launches New Solutions to Help Small Businesses Connect and Grow with the TikTok Community," *TikTok*, July 8, 2020, available at <https://newsroom.tiktok.com/en-us/tiktok-for-business-launches-new-smb-solutions>; "About TikTok Ads Manager," *TikTok: Business Help Center*, May 2024, available at <https://ads.tiktok.com/help/article/tiktok-ads-manager-intro?lang=en>; Allison Schiff, "TikTok Launches Self-Serve Ad Platform With An Eye On Enticing SMBs," *AdExchanger*, July 8, 2020, available at <https://www.adexchanger.com/platforms/tiktok-launches-self-serve-ad-platform-with-an-eye-on-enticing-smbs/>; Megan Graham, "TikTok's new offering for small advertisers could help it lure them from Facebook," *CNBC*, July 8, 2020, available at <https://www.cnn.com/2020/07/08/tiktok-opens-up-self-serve-ad-platform-gives-ad-credits-to-smbs.html>.

<sup>941</sup> "Reach your customers and grow your business with X ads," *X Business*, available at <https://business.x.com/en/advertising.html>; "Billing basics on X Ads," *X Business*, available at <https://business.x.com/en/help/account-setup/billing-basics.html>.

<sup>942</sup> "Ads Manager Overview," *Snapchat Business Help Center*, available at [https://businesshelp.snapchat.com/s/article/global-navigation?language=en\\_US](https://businesshelp.snapchat.com/s/article/global-navigation?language=en_US); "Self-Serve Advertising Terms," *Snap Inc.*, July 25, 2023, available at <https://snap.com/en-US/terms/self-serve-advertising>.

<sup>943</sup> "Amazon Advertising: Announcing a single unified brand," *Amazon Ads*, September 5, 2018, available at <https://advertising.amazon.com/blog/amazon-advertising-simplified>; "Getting started with sponsored ads to help grow your business," *Amazon Ads*, available at <https://advertising.amazon.com/library/guides/getting-started-with-sponsored-ads>.

<sup>944</sup> Irina Kovalenko, "Exploring the Benefits of Self-Serve Ad Networks: 9 Examples," *SmartyAds*, May 22, 2023, available at <https://smartyads.com/blog/best-self-serve-ad-networks/> ("Google Ads is one of the most popular self-serve advertising platforms, offering various advertising options, including search, display, video, and app ads."); "A new way to buy reservation ads in Google Ads," *Google Ads Help*, December 18, 2023, available at <https://support.google.com/google-ads/answer/14325856?hl=en>.

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Advertising,<sup>945</sup> Walmart Ad Center,<sup>946</sup> Disney Advertising and its Hulu Ad Manager,<sup>947</sup> and Vox Media's Concert Ad Manager.<sup>948</sup> Notably, several publishers, including Meta,<sup>949</sup> Amazon,<sup>950</sup>

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<sup>945</sup> "Microsoft Curate," *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en-us/solutions/xandr/curation-platform-self-serve-monetization-solution> ("Experience a self-serve solution with the flexibility to run your business how you want."); Sheen Zheng, and Billie Wei, "Scale your retail media program with a one holistic, easy-to-use platform," *Microsoft Advertising*, May 20, 2024, available at <https://about.ads.microsoft.com/en/blog/post/may-2024/scale-your-retail-media-program-with-a-one-holistic-easy-to-use-platform>.

<sup>946</sup> "Walmart Connect Ramps Up On-Site Offerings with Upcoming Launch of Display Self-Serve Platform and Acquisition of Thunder Advertising Technology," *Walmart*, February 4, 2021, available at <https://corporate.walmart.com/newsroom/2021/02/04/walmart-connect-ramps-up-on-site-offerings-with-upcoming-launch-of-display-self-serve-platform-and-acquisition-of-thunder-advertising-technology>; "Walmart Ad Center," *Walmart Ad Center*, available at <https://advertising.walmart.com/signin?adtechClientId=d8e4dc23-caef-4401-9e36-fa89422644a2&rd=https%3A%2F%2Fadvertising.walmart.com%2Fadtech-plugin-auth>.

<sup>947</sup> [REDACTED]

<sup>948</sup> "Beautiful ads made simple," *Concert*, available at <https://admanager.concert.io>.

<sup>949</sup> [REDACTED] Meta Ads Manager—Meta's self-service platform—enables advertisers to serve ads on inventory that is part of Facebook's Audience Network, which includes third-party publisher properties. See "Use inventory filter in Meta Ads Manager," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/252190302162738?id=1769156093197771>. From 2017 to 2020, Facebook Audience Network provided access to mobile web, instream, and app ads, and in 2020, Facebook transitioned to app ads. See "Changes to Web and In-Stream Placements," *Meta Business Help Center*, available at <https://www.facebook.com/business/help/645132129564436>.

<sup>950</sup> "Getting started with sponsored ads to help grow your business," *Amazon Ads*, available at <https://advertising.amazon.com/library/guides/getting-started-with-sponsored-ads>; "Sponsored Display," *Amazon Ads*, available at <https://advertising.amazon.com/solutions/products/sponsored-display> ("Sponsored Display helps businesses reach customers wherever they spend time, across the Amazon store plus thousands of apps and websites.").



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Microsoft,<sup>951</sup> Google,<sup>952</sup> Vox Media,<sup>953</sup> and Walmart,<sup>954</sup> to name a few, enable advertisers to use their self-service platforms to also buy ad space on third-party publisher properties.

293. **Path 2** represents a scenario in which an advertiser negotiates a direct deal with a publisher, without use of any intermediaries, as described above in **Section VII.A**. These sales are implemented through a direct connection between the advertiser's ad server (not depicted in the table) and the publisher's ad server. For example, Target (as an advertiser) could use Microsoft's Xandr Monetize ad server to implement a direct sale contract it negotiated with The New York Times.<sup>955</sup> [REDACTED]

[REDACTED].<sup>956</sup>

294. Another variant of direct deals is programmatic guaranteed transactions, in which the terms are still negotiated directly between the buyer and seller, but the negotiation takes place via

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<sup>951</sup> "Microsoft Curate," *Microsoft Advertising*, available at <https://about.ads.microsoft.com/en-us/solutions/xandr/curation-platform-self-serve-monetization-solution> ("Experience a self-serve solution with the flexibility to run your business how you want.").

<sup>952</sup> Irina Kovalenko, "Exploring the Benefits of Self-Serve Ad Networks: 9 Examples," *SmartyAds*, May 22, 2023, available at <https://smartyads.com/blog/best-self-serve-ad-networks/> ("Google Ads is one of the most popular self-serve advertising platforms, offering various advertising options, including search, display, video, and app ads."); GOOG-DOJ-13518329 at 330-31 (noting launch of AwBid, which enabled AdWords advertisers to "bid[] on external exchange inventory"); "Google AdWords is now Google Ads," *Google Ads Help*, available at <https://support.google.com/google-ads/answer/9028765?hl=en>.

<sup>953</sup> "Vox Media introduces Concert Ad Manager, a self serve tool for marketers," *Vox Media*, September 29, 2020, available at <https://www.voxmedia.com/2020/9/29/21473644/vox-media-introduces-concert-ad-manager-a-self-serve-tool-for-marketers> ("Today, Vox Media announces Concert Ad Manager, a self-service tool giving brands, particularly small and medium size businesses, the ability to build and deploy advertising campaigns at scale, across premium publishers within the Concert and Concert Local marketplaces."); "Reimagine Brand Advertising," *Concert*, available at <https://concert.io/> ("Concert [marketplace] reaches over 90% of the US online audience with elevated access to the most prized national and local publishers. Built on exclusive ad technology and first party data, our trusted marketplace delivers high performing ad experiences in premium environments at scale.").

<sup>954</sup> "Walmart Connect Ramps Up On-Site Offerings with Upcoming Launch of Display Self-Serve Platform and Acquisition of Thunder Advertising Technology," *Walmart*, February 4, 2021, available at <https://corporate.walmart.com/newsroom/2021/02/04/walmart-connect-ramps-up-on-site-offerings-with-upcoming-launch-of-display-self-serve-platform-and-acquisition-of-thunder-advertising-technology>; Stuart Clay, "Walmart's retail media network: What advertisers need to know," *Search Engine Land*, February 9, 2023, available at <https://searchengineland.com/walmart-retail-media-network-advertisers-392702>.

<sup>955</sup> "About Microsoft Monetize," *Xandr Platform*, May 10, 2024, available at <https://learn.microsoft.com/en-us/xandr/monetize/about-monetize>; "Introduction to Ad serving," *Xandr Platform*, March 2, 2024, available at <https://learn.microsoft.com/en-us/xandr/industry-reference/introduction-to-ad-serving>.

<sup>956</sup> [REDACTED]



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the interfaces of a DSP and SSP.<sup>957</sup> For example, a publisher could use Microsoft Monetize ad server to negotiate the terms of a programmatic guaranteed deal with a buyer using Microsoft Invest DSP.<sup>958</sup>

295. **Path 3** represents a scenario in which an impression is sold through an ad network that connects directly to both the advertiser and the publisher, without any other ad tech intermediary, as described in **Section VII.M**. In this path, the ad network has ad serving functionality and thus a third-party ad server is not needed. Ad networks such as Meta Audience Network,<sup>959</sup> Taboola,<sup>960</sup> and Outbrain<sup>961</sup> all connect directly with publishers.

296. **Path 4** is similar to Path 3, but instead of serving the ad through the ad network's own integrated ad server, a third-party ad server is used to serve the ad.<sup>962</sup> For example, a publisher could display an ad transacted via the ad network Criteo through Equativ's ad server.<sup>963</sup>

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<sup>957</sup> "Modernize your direct deals with Programmatic Guaranteed," *Google Ad Manager*, available at <https://admanager.google.com/home/resources/feature-brief-programmatic-guaranteed/> ("Programmatic Guaranteed modernizes direct ad buying. It expands on the promise of programmatic advertising — an automated buying process — to deliver more value to both advertisers and publishers by allowing them to implement direct reservation-style buys more easily than ever before. [...] Reduced discrepancies and waste: Integrated buy and sell-side platforms enable faster troubleshooting and fewer discrepancies.").

<sup>958</sup> "Selling Programmatic Guaranteed deals," *Xandr Platform*, February 7, 2024, available at [https://docs.xandr.com/bundle/monetize\\_monetize-standard/page/topics/programmatic-guaranteed-selling-line-items.html](https://docs.xandr.com/bundle/monetize_monetize-standard/page/topics/programmatic-guaranteed-selling-line-items.html) ("Programmatic guaranteed (PG) selling line items provide a workflow for you to for [sic] create and sell PG deals to buyers who use Microsoft Invest and other partner DSPs.").

<sup>959</sup> "Monetize your mobile game," *Meta Audience Network*, available at <https://www.facebook.com/audiencenetwork/> ("Meta Audience Network empowers app developers and publishers to deliver a great user experience while growing a sustainable business."); "Glossary: Facebook Audience Network," *Lunio*, available at <https://lunio.ai/glossary/facebook-audience-network/> ("When a user visits a participating app or website, the Facebook Audience Network software will use this information to serve an ad that is relevant to the user.").

<sup>960</sup> "How Taboola Works," *Taboola Help Center*, available at <https://help.taboola.com/hc/en-us/articles/115006597307-How-Taboola-Works> ("Through our exclusive partnerships with many of the world's top publishers, we serve 360 billion content recommendations to over one billion people across the web each month.").

<sup>961</sup> "Native Ad Server: The Industry's Only End-to-End Native Ad Server," *Outbrain*, available at <https://www.outbrain.com/publishers/native-ad-server/> ("The only end-to-end platform to manage serving and selling built for native advertising.").

<sup>962</sup> Maciej Zawadziński, and Mike Sweeney, "What Is an Ad Network and How Does It Work?" *Clearcode*, May 16, 2024, available at <https://clearcode.cc/blog/what-is-an-ad-network-and-how-does-it-work/> ("The advertiser can set up the campaigns directly using an ad network's campaign-management panel, or set up pixels from a third-party ad server for verification purposes and consolidated reporting when running the campaign across multiple ad networks and in direct deals with publishers.").

<sup>963</sup> "Our partners," *Criteo*, available at <https://www.criteo.com/privacy/our-partners/>.

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271. **Path 5** simultaneously involves all the ad tech products discussed in Plaintiffs' experts' reports and is one of the few pathways on which they focus.<sup>964, 965</sup> This path represents a scenario in which an advertiser uses a DSP to bid on a publisher's inventory via an SSP or ad exchange, and the winning ad is served by an ad server. For example, Dentsu could use Amazon's DSP to place a bid for an ad on The Washington Post's inventory through OpenX, which, if won, could then be served via The Washington Post's internal publisher ad server.<sup>966</sup>

297. **Path 6** is a particular case of Path 5, in which the ad exchange/SSP that transacts the winning ad is called through header bidding. For example, an advertiser could use The Trade Desk to place an ad on inventory sold through OpenX's SSP, which was called by Amazon's Transparent Ad Marketplace header bidding solution.<sup>967</sup> The ad could then be served via Magnite's SpringServe ad server (which has an integration with Amazon's header bidding tool).<sup>968</sup>

298. **Path 7** is similar to Path 5, but in this path, the ad exchange/SSP serves the ad through an ad tag on the publisher's page, without an ad server. For example, a publisher can serve an ad

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<sup>964</sup> Gans Report, Figure 2 ("Information flow and decision-logic in the programmatic ad tech ecosystem"), Footnote 101 ("While not all tools in the ad tech stack *directly* interact with both sides of the market (publishers and advertisers), it is still reasonable to consider ad tech tools as bringing the two sides of the market together (i.e., transacting demand from advertisers and supply from publishers). The products in each of the relevant product markets I define (publisher ad servers, ad exchanges, ad buying tools for large advertisers, and ad buying tools for small advertisers) facilitate transactions between publishers and advertisers.") (emphasis in original); Chandler Report, ¶ 141 ("The programmatic purchase and sale of display advertising space is effectuated through services provided by intermediary 'ad tech' platforms and tools, which generally include, but are not always limited to: (a) a publisher inventory management system; (b) a publisher ad server; (c) a publisher selling tool; (d) an advertising exchange; (e) an advertiser ad server; and (f) an advertiser buying tool.").

<sup>965</sup> As described earlier, advertisers can use advertiser ad servers to organize and serve ad creatives to different websites and track the performance of their ad campaigns across multiple websites. I exclude advertiser ad servers from **Table 2** as I understand they are not part of the relevant product markets alleged by Plaintiffs.

<sup>966</sup> "Dentsu International," *Amazon Ads*, available at <https://advertising.amazon.com/partners/directory/details/amzn1.ads1.ma1.f52s6k2jccez66iz43nd08sax/Dentsu-International>; "A Look Under the Hood, Amazon's DSP," *Mindstream Media Group*, available at <https://mindstreammediagroup.com/a-look-under-the-hood-amazons-dsp/>; "Ads.txt," *The Washington Post*, April 5, 2022, available at <https://www.washingtonpost.com/ads.txt> (mentioning OpenX as one of the intermediaries that The Washington Post works with).

<sup>967</sup> "Transparent Ad Marketplace," *Amazon Publisher Services*, available at <https://aps.amazon.com/aps/transparent-ad-marketplace/>; "Buyers," *OpenX*, available at <https://www.openx.com/buyers/>.

<sup>968</sup> "SpringServe joins the Amazon Publisher Services Streaming TV Ad Server Certification Program," *Magnite*, March 10, 2023, available at <https://investor.magnite.com/news-releases/news-release-details/springserve-joins-amazon-publisher-services-streaming-tv-ad>.

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without an ad server by placing Sovrn’s ad tag directly on its page (commonly referred to as “hardcoding”).<sup>969</sup>

299. **Path 8** represents a version of supply path optimization in which an advertiser uses an SSP directly to place an ad without the use of a DSP. As an example, PubMatic’s Activate feature gives advertisers the ability to “log in directly to the SSP and book their ad campaigns, a contrast to the more orthodox method of programmatic media buying via DSPs.”<sup>970</sup>

300. **Path 9** represents a version of supply path optimization in which an advertiser uses a DSP to purchase inventory directly from a publisher without the use of an ad exchange. Advertisers can do so through, for example, the Trade Desk’s OpenPath<sup>971</sup> and Yahoo DSP’s Backstage.<sup>972</sup>

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<sup>969</sup> “Glossary of Ad-Tech and Sovrn Terms,” *Sovrn*, available at <https://knowledge.sovrn.com/s/article/Glossary-of-Ad-Tech-and-Sovrn-Terms-1677510997914> (“Hard coding - Literally placing the ad tag within the code on the publisher’s webpage instead of placing the tag within an ad server.”); “Ad Tags in Ad Exchange,” *Sovrn*, available at <https://knowledge.sovrn.com/s/article/Ad-Tags-in-Ad-Exchange-1677511077611>; Sovrn Advertising Team, “All About Ad Servers,” *Sovrn*, March 8, 2022, available at <https://www.sovrn.com/blog/all-about-ad-servers/> (“SSPs give content creators the ability to set up ad tags based on their website layout. Once those ad tags are created, they place the ad tags on their site. Ads are then shown through the ad tag and the publisher is paid based on the number of times that the ad is shown to a reader.”); sovrnmarketing, “What Is an Ad Server?” *Sovrn*, November 8, 2016, available at <https://www.sovrn.com/blog/what-is-an-ad-server/> (“If you’re an early blogger or website, chances are you won’t need to utilize an ad server quite yet. In that case, you can ‘Hard Code’ an ad tag directly on any webpage on your site.”).

<sup>970</sup> Ronan Shields, “PubMatic debuts Activate, as the line between demand- and sell-side players continues to blur,” *Digiday*, May 8, 2023, available at <https://digiday.com/media/pubmatic-debuts-activate-as-the-line-between-demand-and-sell-side-players-continues-to-blur/>; “PubMatic Launches Activate, Bringing Programmatic Automation to Direct Deals for CTV and Video,” *GlobeNewswire*, May 8, 2023, available at <https://www.globenewswire.com/en/news-release/2023/05/08/2663084/0/en/PubMatic-Launches-Activate-Bringing-Programmatic-Automation-to-Direct-Deals-for-CTV-and-Video.html> (“This groundbreaking new end-to-end supply path optimization (SPO) solution allows buyers to execute non-bidder direct deals on PubMatic’s programmatic platform, accessing premium video and CTV inventory at scale. Initial launch partners include dentsu, FuboTV, GroupM, Havas, LG, Mars, and Omnicom Media Group Germany, among others.”).

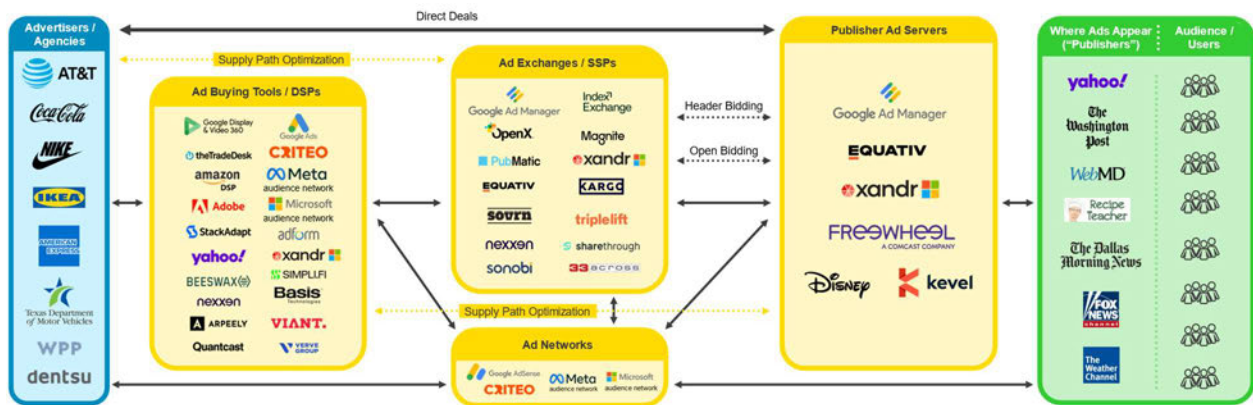
<sup>971</sup> “OpenPath: Your pipeline to the open internet,” *The Trade Desk*, available at <https://www.thetradedesk.com/us/our-platform/openpath>; “The Trade Desk Launches OpenPath, Providing Advertisers with Direct Access to Premium Publisher Advertising Inventory,” *The Trade Desk*, February 15, 2022, available at <https://investors.thetradedesk.com/news-events/news-details/2022/The-Trade-Desk-Launches-OpenPath-Providing-Advertisers-with-Direct-Access-to-Premium-Publisher-Advertising-Inventory-02-20-2022/default.aspx>; Anthony Vargas, “Is The Trade Desk Encroaching On SSP Turf With OpenPath?” *AdExchanger*, March 3, 2022, available at <https://www.adexchanger.com/publishers/is-the-trade-desk-encroaching-on-ssp-turf-with-openpath/>.

<sup>972</sup> “Yahoo Advertising to Launch Yahoo Backstage, Enabling a Direct Path to Premium Publisher Inventory,” *Yahoo!*, June 19, 2023, available at <https://www.yahoo.com/press/yahoo-advertising-to-launch-yahoo-backstage-enabling-a-direct-path-to-premium-publisher-inventory>; “Yahoo Backstage: Yahoo DSP,” *Yahoo!*

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301. **Figure 32** provides a simplified illustration of many of these pathways, along with examples of firms offering different ad tech tools. Importantly, this figure does not include the self-service platforms described in Path 1, even though advertisers spend a significant portion of their display advertising budget on those platforms.

**Figure 32. Examples of Firms Offering “Open Web” Ad Tech Tools**



**Notes:**

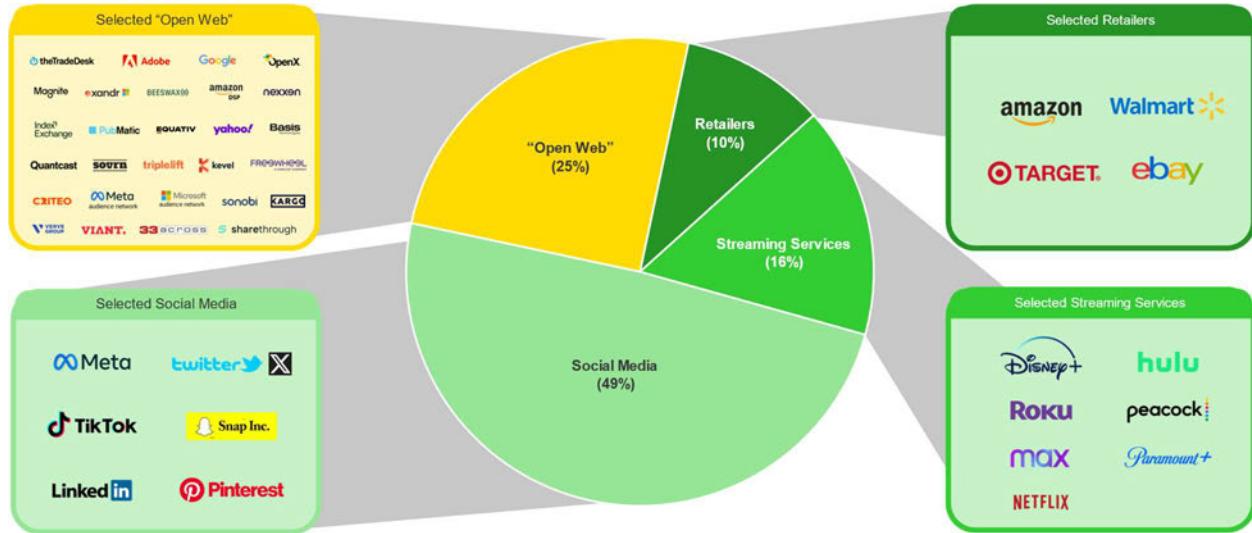
[1] This figure is reproduced as **Figure D-8** in **Appendix D**.

302. **Figure 33** illustrates how 49% of advertisers’ display ad spending occurs with social media platforms, 10% occurs with retailer platforms, and 16% occurs with streaming services. By focusing on their alleged “open web” market, Plaintiffs and their experts miss the larger and growing parts of the innovative and dynamic display advertising industry.

*Advertising*, available at <https://www.advertising.yahooinc.com/our-dsp/yahoo-backstage> (“Our direct access to publisher supply offering, Yahoo Backstage, is your all-access pass to scalable premium inventory.”).

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**Figure 33. Plaintiffs Focus on a Fraction of Display Ad Spending**



**Notes:**

[1] As shown in **Figure 10**, **Figure 15**, and **Figure 17**, ad spending on social media, retail media, and connected TV accounts for 49%, 10%, and 16% of the total display ad spending in the U.S. in 2023, respectively. These figures include ad spending on publishers' self-service platforms as well as through their ad tech products (such as ad networks or DSPs).

[2] This figure is reproduced as **Figure D-9** in **Appendix D**.

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**APPENDIX A**

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**ACADEMIC EXPERIENCE**

5/2017 – Present	<b>NYU Stern School of Business</b> Heinz Riehl Chair Professor of Business
5/2013 – 4/2017	<b>NYU Stern School of Business</b> Professor of Technology, Operations, and Statistics and Professor of Marketing NEC Faculty Fellow
4/2017 – Present	<b>NYU Stern School of Business</b> Director, Master of Business Analytics (MSBA) Program
5/2016 – Present	<b>NYU Stern School of Business</b> Co-Director, Master of Business Analytics (MSBA) Capstone
2/2016 – Present	<b>NYU Stern School of Business</b> Stern Faculty Scholar
8/2012 – 4/2017	<b>NYU Stern School of Business</b> Director, Center for Business Analytics (CBA)
9/2013 – 12/2014	<b>NYU</b> Co-Chair, NYU-AIG Partnership on Innovation for Global Resilience
5/2010 – 4/2013	<b>NYU Stern School of Business</b> Associate Professor (with tenure) Robert L. & Dale Atkins Rosen Faculty Fellow Daniel Paduano Fellow
8/2011 – 7/2012	<b>Wharton School of Business, University of Pennsylvania</b> Visiting Professor
1/2011 – 6/2012	<b>NYU Stern School of Business</b> Co-Director, Center for Digital Economy Research (CeDER)
9/2004 – 4/2010	<b>NYU Stern School of Business</b> Assistant Professor

**EDUCATION**

2004	<b>Tepper School of Business, Carnegie Mellon University, USA</b> Ph.D. Information Systems
2002	<b>Tepper School of Business, Carnegie Mellon University, USA</b> M.S. Information Systems
1998	<b>Indian Institute of Management, Calcutta, India</b> M.B.A. Finance, Marketing, & Information Systems
1996	<b>National Institute of Technology (NIT) Jalandhar, India</b> B.Tech. Instrumentation & Control Engineering



**APPENDIX A**

**SELECTED ACADEMIC HONORS AND AWARDS**

- **2023** Cited in the 2023 Economic Report of the President
- **2023** Best Paper Award Finalist, Management Science (IS Department)
- **2022** AIS Fellow Award
- **2022** Distinguished Alumni Award IIM Calcutta
- **2022** Best Impact Paper Award, International Conference on Information Systems (ICIS)
- **2022** Best Dissertation Award, Workshop on Information Technology Systems (WITS)
- **2022** Best Student Paper Finalist, WISE (Workshop on Information Systems Economics)
- **2022** INFORMS ISS Nunamaker-Chen Best Dissertation Runner-Up Award
- **2022** Best Paper Award Finalist, Management Science (IS Department)
- **2021** Best Student Paper Award, International Conference on Information Systems (ICIS)
- **2021** Best Paper Runner-Up Award, Information Systems Research (ISR)
- **2021** Nominated for CSWIM 2021 Best Paper Award
- **2020** INFORMS IS Practical Impact Award
- **2020** Best Paper Award Finalist, Management Science
- **2020** Appointment as Department Editor (IS) of Management Science
- **2019** Top 1% Highest Cited Researcher Recognition by Thomson Reuters
- **2019** Best Paper Award, Workshop in Information Technology Systems (WITS)
- **2019** NYU Stern Schoolwide Distinguished Teaching Award
- **2018** Axiom Business Book Gold Award for TAP in Business Technology category
- **2018** Axiom Business Book Bronze Award for TAP in Economics category
- **2018** Nominated for Best Paper, INFORMS-CIST conference
- **2018** Nominated for Information Systems Research Best Paper Award
- **2017** Thinkers50 Distinguished Achievement Nomination (Digital Thinker Award)
- **2017** Thinkers50 Radar Award for Top 30 Management Thinkers Globally
- **2017** POMS Healthcare Best Student Paper Award Finalist
- **2016** Best Student Paper Award in Workshop on Health IT and Economics (WHITE)
- **2016** National Science Foundation EAGER Award
- **2015** Distinguished Fellow Award from INFORMS Information Systems Society
- **2015** Nominated for Best Paper, INFORMS-CIST conference
- **2015** Best Paper Award in MIS Quarterly for 2015
- **2015** Best AIS Paper Award from Association of Information Systems
- **2015** NET Institute Grant
- **2015** Marketing Science Institute Award
- **2015** Adobe Faculty Research Award
- **2014** Best Paper Award in Management Science IS department from the last 3 years (2011-2013)
- **2014** Best Paper Award in Information Systems Research for 2014
- **2014** Best Overall Conference Paper Award, American Marketing Association Conference
- **2014** Best Digital Marketing Track Paper Award, American Marketing Association Conference
- **2014** Kauffman Foundation Grant
- **2014** Selected for “Top 40 under 40 Business School Professors Worldwide” by Poets & Quants



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- **2014** Selected for “Top 200 Thought Leaders in Big Data and Business Analytics” by Analytics Week
- **2013** Google Faculty Research Award
- **2012** Best Theme Paper Award, International Conference on Information Systems (ICIS)
- **2012** Marketing Science Institute Award
- **2012** SEI-Wharton Future of Advertising Grant
- **2012** Institute on Asian Consumer Insights Award
- **2012** Google Faculty Research Award
- **2012** NET Institute Grant
- **2012** NYU Abu Dhabi Institute Seed Grant
- **2011** Best Paper Award, Workshop on Health IT and Economics (WHITE)
- **2011** Daniel P. Paduano Fellowship at NYU Stern
- **2011** Delphi Big Think Fellowship
- **2011** Best Paper Award, 20<sup>th</sup> International World Wide Web Conference (WWW)
- **2011** Marketing Science Institute Young Scholar
- **2011** NYU Abu Dhabi Institute Seed Grant
- **2010** Google-WPP Marketing Research Award
- **2010** National Science Foundation IGERT Award
- **2010** MSI-Wharton Interactive Media Initiative (WIMI) Award
- **2009** Meritorious Service Award (Associate Editor) for Management Science
- **2009** MSI-Wharton Interactive Media Initiative (WIMI) Award
- **2009** NYU-Poly Research Award
- **2009** National Science Foundation SFS ASPIRE Award
- **2009** NYU Stern Center for Japan-US Business and Economics Studies Grant
- **2008** Best Paper Award Nominee, Workshop on Information Technology and Systems (WITS)
- **2008** NET Institute Grant
- **2007** Best Track Paper Award (WISA) International Conference on Information Systems
- **2007** Best Paper Award Nominee International Conference on Information Systems
- **2007** Best Published Paper Runner-Up Award in *Information Systems Research*
- **2007** Marketing Science Institute Award
- **2007** Microsoft Virtual Earth Award
- **2007** National Science Foundation CAREER Award
- **2006** Microsoft Live Labs Award
- **2006** NET Institute Grant
- **2005** ACM SIGMIS Doctoral Dissertation Award (1<sup>st</sup> Runner-Up)
- **2005** Best Paper Award Nominee Hawaiian International Conference on System Sciences (HICSS)
- **2004** Best Paper Award Nominee, International Conference on Information Systems (ICIS)
- **2003** Doctoral Consortium Fellow, International Conference on Information Systems
- **2000** William Larimer Doctoral Fellowship at Carnegie Mellon University

## APPENDIX A

### REFEREED JOURNAL PUBLICATIONS

1. Sun, C., A. Ghose, X. Liu, and Z. Shi. 2024. The Effect of Voice AI on Digital Commerce. Conditionally Accepted, *Information Systems Research*.  
  - **Nominated for CSWIM 2021 Best Paper Award**
2. Molitor, D., M. Spann, A. Ghose, and P. Reichhart. 2024. Mobile Push versus Pull Targeting and Geo-Conquesting. Forthcoming, *Information Systems Research*.
3. Ghose, A., H. Lee, K. Nam, and W. Oh. 2024. The Effects of Pressure and Self-Assurance Nudges on Product Purchases and Returns in Online Retailing: Evidence from a Randomized Field Experiment, *Journal of Marketing Research*, 61(3), 517-535.
4. Ghose, A., H. Lee, W. Oh, and Y. Son. 2023. Leveraging the Digital Tracing Alert in Virus Fight: The Impact of COVID-19 Cell Broadcast on Population Movement, *Information Systems Research*, 35 (2), 570-589.
5. Macha, M., N. Foutz, B. Li, and A. Ghose. 2023. Personalized Privacy Preservation in Consumer Mobile Trajectories, forthcoming, *Information Systems Research*, 35(1):249-271.  
  - **WITS 2019 Best Paper Award**
6. Xu, Y., B. Lu, A. Ghose, H. Dai, and W. Zhou. 2023. The Interplay of Earnings, Ratings, and Penalties on Sharing Platforms: An Empirical Investigation, *Management Science*, 69(10), 6128-6146.
7. Xu, Y., A. Ghose, and B. Xiao. 2023. Mobile Payment Adoption: An Empirical Investigation of Alipay, forthcoming, *Information Systems Research* 35 (2), 807-828.
8. Joo, M., S. Kim, A. Ghose, and K. Wilbur. 2023. Designing Distributed Ledger technologies, like Blockchain, for advertising markets, *International Journal of Research in Marketing*, 40(1), 12-21.
9. Fernández-Loría, C., M. Cohen, and A. Ghose. 2023. Evolution of Referrals over Customers' Life Cycle: Evidence from a Ride-Sharing Platform, *Information Systems Research*, 34(2), 698-720.
10. Ghose, A., X. Guo, B. Li, and Y. Dang. 2022. Empowering Patients Using Smart Mobile Health Platforms: Evidence From a Randomized Field Experiment, *MIS Quarterly*, 46(1), 151-192.
11. Adamopoulos, P., A. Ghose, and A. Tuzhilin. 2022. Heterogeneous Demand Effects of Recommendation Strategies in a Mobile Application: Evidence from Econometric Models and Machine-Learning Instruments, *MIS Quarterly*, 46(1), 101-150.
12. Sun, C., P. Adamopoulos, A. Ghose, and X. Luo. 2022. Predicting Stages in Omnichannel Path to Purchase: A Deep Learning Model, *Information Systems Research*, 33(2), 429-445.
13. Xu, Y., M. Armony, and A. Ghose. 2021. The Interplay Between Online Reviews and Physician Demand: An Empirical Investigation, *Management Science*, 67(12), 7344-7361.  
  - **Finalist, 2017 POMS Healthcare Best Student Paper Award**
  - **Best Student Paper Award, 2016 Workshop on Health IT and Economics (WHITE)**
  - **Best Paper Award Finalist, 2023 Management Science (IS Department)**
14. Cui, T., A. Ghose, H. Halaburda, R. Iyengar, K. Pauwels, S. Sriram, C. Tucker, and S. Venkataraman. 2021. Informational Challenges in Omnichannel Marketing: Remedies and Future Research, *Journal of Marketing*, 85(1), 103-120.
15. Adamopoulos, P., V. Todri, and A. Ghose. 2021. Demand Effects of the Internet-of-Things Sales Channel: Evidence from Automating the Purchase Process, *Information Systems Research*, 32(1), 238-267.  
  - **Nominated for INFORMS CIST 2018 Best Paper Award**
16. Todri, V, A. Ghose, and P. Singh. 2020. Trade-Offs in Online Advertising: Advertising Effectiveness and Annoyance Dynamics Across the Purchase Funnel, *Information Systems Research*, 31(1), 102-125.

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• **Best Paper Runner-Up Award in Information Systems Research**

17. Molitor, D., M. Spann, A. Ghose, and P. Reichhart. 2020. Effectiveness of Location-Based Advertising and the Impact of Interface Design, *Journal of Management Information Systems*, 37(2), 431-456.
18. Ghose, A., B. Li, and S. Liu. 2019. Mobile Targeting Using Customer Trajectory Patterns, *Management Science*, 65(11), 5027-5049.

• **Best Paper Award Finalist, Management Science (IS Department)**

19. Ghose, A., H. Kwon, D. Lee, and W. Oh. 2019. Seizing the Commuting Moment: Contextual Targeting Based on Mobile Transportation Apps, *Information Systems Research*, 30(1), 154-174.
20. Chan, J., P. Mojumder., and A. Ghose. 2019. The Digital Sin City: An Empirical Study of Craigslist's Impact on Prostitution Trends, *Information Systems Research*, 30(1), 219-238.
21. Ghose, A., P. Ipeirotis, and B. Li. 2019. Modeling Consumer Footprints on Search Engines: An Interplay with Social Media, *Management Science*, 65(3), 1363-1385.

• **Best Theme Paper Award at 2012 International Conference on Information Systems**

22. Zhang, S., P. Singh, and A. Ghose. 2019. A Structural Analysis of the Role of Superstars in Crowdsourcing Contests, *Information Systems Research*, 30(1), 15-33.
23. Adamopoulos, P., A. Ghose, and V. Todri. 2018. The Impact of User Personality Traits on Word of Mouth: Text-Mining Social Media Platforms, *Information Systems Research*, 29(3), 612-640.

• **Best Paper Award Finalist in Information Systems Research**

24. Xu, K., J. Chan, A. Ghose, and S. Han. 2017. Battle of the Channels: The Impact of Tablets on Digital Commerce, *Management Science*, 63(5), 1469-1492.

• **Best Paper Finalist Award in Management Science**

25. Burtch, G., A. Ghose, and S. Wattal. 2016. Secret Admirers: An Empirical Examination of Information Hiding and Contribution Dynamics in Online Crowdfunding, *Information Systems Research*, 27(3), 478-496.
26. Ghose, A., and V. Todri-Adamopoulos. 2016. Toward a Digital Attribution Model: Measuring the Impact of Display Advertising on Online Consumer Behavior, *MIS Quarterly*, 40(4), 889-910.

• **Nominated for INFORMS CIST 2015 Best Paper Award**

27. Chan, J., A. Ghose, and R. Seamans. 2016. The Internet and Racial Hate Crime: Offline Spillovers From Online Access, *MIS Quarterly*, 40(2), 381-403.
28. Andrews, M., X. Luo, Z. Fang, and A. Ghose. 2016. Mobile Ad Effectiveness: Hyper-Contextual Targeting with Crowdedness, *Marketing Science*, 35(2), 218-233.

• **Best Overall Conference Paper Award at 2014 American Marketing Association Conference**

• **Best Track Paper Award in Digital Marketing at 2014 American Marketing Association Conference**

29. Huang, Y., P. Singh, and A. Ghose. 2015. A Structural Model of Employee Behavioral Dynamics in Enterprise Social Media, *Management Science*, 61(12), 2825-2844.
30. Burtch, G., A. Ghose, and S. Wattal. 2015. The Hidden Cost of Accommodating Crowdfunder Privacy Preferences: A Randomized Field Experiment, *Management Science*, 61(5), 949-962.
31. Ghose, A., and S. Han. 2014. Estimating Demand for Mobile Applications in the New Economy, *Management Science*, 60(6), 1470-1488.
32. Chan, J., and A. Ghose. 2014. Internet's Dirty Secret: Assessing the Impact of Online Intermediaries on HIV Transmission, *MIS Quarterly*, 38(4), 955-976.

• **Best Paper Award at the 2011 Workshop on Health IT and Economics**

• **Best Paper Award in MIS Quarterly**

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### • **Best Paper Award in AIS**

33. Burtch, G., A. Ghose, and S. Wattal. 2014. Cultural Differences and Geography as Determinants of Online Prosocial Lending, *MIS Quarterly*, 38(3), 773-794.
34. Ghose, A., P. Ipeirotis, and B. Li. 2014. Examining the Impact of Ranking on Consumer Behavior and Search Engine Revenue, *Management Science*, 60(7), 1632-1654.
35. Lambrecht, A., A. Goldfarb, A. Bonatti, A. Ghose, D. Goldstein, R. Lewis, A. Rao, N. Sahni, and S. Yao. 2014. How do firms make money selling digital goods online, *Marketing Letters*, 25(3), 331-341.
36. Burtch, G., A. Ghose, and S. Wattal. 2013. An Empirical Examination of the Antecedents and Consequences of Contribution Patterns in Crowd-Funded Markets, *Information Systems Research*, 24(3), 499-519. **(Lead Article)**

### • **2013 ISR Best Published Paper Award**

37. Ghose, A., A. Goldfarb, and S. Han. 2013. How Is the Mobile Internet Different? Search Costs and Local Activities, *Information Systems Research*, 24(3), 613-631.
38. Ghose, A., P. Ipeirotis, and B. Li. 2012. Designing Ranking Systems for Hotels on Travel Search Engines by Mining User-Generated and Crowdsourced Content, *Marketing Science*, 31(3), 493-520.

### • **Best Paper Award at the 2011 International World Wide Web Conference**

39. Ghose, A., and S. Han. 2011. An Empirical Analysis of User Content Generation and Usage Behavior on the Mobile Internet, *Management Science*, 57(9), 1671-1691.
40. Archak, N., A. Ghose, and P. Ipeirotis. 2011. Deriving the Pricing Power of Product Features by Mining Consumer Reviews, *Management Science*, 57(8), 1485-1509.

### • **Best Paper Award from 2011-2013**

41. Ghose, A., and P. Ipeirotis. 2011. Estimating the Helpfulness and Economic Impact of Product Reviews: Mining Text and Reviewer Characteristics, *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, 23(10), 1498-1512.
42. Ghose, A., and O. Yao. 2011. Using Transaction Prices to Re-Examine Price Dispersion in Electronic Markets, *Information Systems Research*, 22(2), 269-288.
43. Dhar, V., and A. Ghose. 2010. Research Commentary—Sponsored Search and Market Efficiency, *Information Systems Research*, 21(4), 760-772.
44. Yang, S., and A. Ghose. 2010. Analyzing the Relationship Between Organic and Sponsored Search Advertising: Positive, Negative, or Zero Interdependence, *Marketing Science*, 29(4), 602-623.
45. Ghose, A., and S. Yang. 2009. An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets, *Management Science*, 55(10) 1605-1622. **(Lead Article)**
46. Ghose, A., and K. Huang. 2009. Personalized Pricing and Quality Customization, *Journal of Economics and Management Strategy*, 18(4), 1095-1135.
47. Forman, C., A. Ghose, and A. Goldfarb. 2009. Competition Between Local and Electronic Markets: How the Benefit of Buying Online Depends on Where You Live, *Management Science*, 55(1), 47-57.
48. Ghose, A. 2009. Internet Exchanges for Used Goods: An Empirical Analysis of Trade Patterns and Adverse Selection, *MIS Quarterly*, 33(2), 263-291.
49. Ghose, A., and P. Ipeirotis. 2009. The EconoMining Project at NYU: Studying the Economic Value of User-Generated Content on the Internet, *Journal of Revenue and Pricing Management*, 8(2-3), 241-246.
50. Forman, C., A. Ghose, and B. Wiesenfeld. 2008. Examining the Relationship Between Reviews and Sales: The Role of Reviewer Identity Disclosure in Electronic Markets, *Information Systems Research*, 19(3), 291-313.
51. Arora N., X. Dreze, A. Ghose, J. Hess, R. Iyengar, B. Jing, Y. Joshi, V. Kumar, N. Lurie, S. Neslin, S. Sajeesh, M. Su, N. Syam, J. Thomas, and Z. Zhang. 2008. Putting one-to-one marketing to work: Personalization, customization and choice, *Marketing Letters*, 19(3-4), 305-321. **(Invited paper)**

## **APPENDIX A**

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53. Ghose, A., and A. Sundararajan. 2006. Evaluating Pricing Strategy Using e-Commerce Data: Evidence and Estimation Challenges, *Statistical Science*, 21(2), 131-142.
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38. Chan, J., A. Ghose, and R. Seamans. 2013. The Internet and Hate Crime. *Workshop on Information Systems and Economics (WISE), Milan, December*.
39. Ghose, A., S. Han, and S. Park. 2013. Analyzing the Interdependence Between Web and Mobile Advertising, *Marketing Science Conference, Istanbul, July*.
40. Molitor, D., M. Spann, and A. Ghose. 2013. Measuring the Effectiveness of Location-Based Advertising. Randomized Field Experiments Comparing PC with Mobile, *Marketing Science Conference, Istanbul, July*.
41. Ghose, A., S. Han, and S. Park. 2013. Analyzing the Interdependence Between Web and Mobile Advertising, *Wharton Customer Analytics Conference, Wharton School, May*.
42. Anindya Ghose, Panos Ipeirotis, and Beibei Li. 2012. Surviving Social Media Overload: Predicting Consumer Footprints on Product Search Engines. *Workshop on Information Systems and Economics (WISE), Orlando, December*.
43. Chan, J., and A. Ghose. 2012. Internet's Dirty Secret: Assessing the Impact of Online Intermediaries on the Outbreaks of STDs, *National Bureau of Economic Research Summer Meetings, Boston*.
44. Chan, J., and A. Ghose. 2012. Internet's Dirty Secret: Assessing the Impact of Online Intermediaries on the Outbreaks of STDs, *Statistical Challenges in E-Commerce Research (SCECR), Montreal*.
45. Ghose, A., and S. Han. 2012. Mobile Advertising and App Adoption in the New Mobile Economy, *Statistical Challenges in E-Commerce Research (SCECR), Montreal*.
46. Ghose, A., P. Ipeirotis, and B. Li. 2012. Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content, *Research Frontiers in Marketing Science Conference, University of Texas at Dallas, February*.
47. Ghose, A., P. Ipeirotis, and B. Li. 2011. Examining the Impact of Search Engine Ranking and Personalization on Consumer Behavior: Combining Bayesian Modeling with Randomized Field Experiments. *Workshop on Information Systems and Economics (WISE), Shanghai, December*.
48. Ghose, A., A. Goldfarb, and S. Han. 2011. How is the Mobile Internet Different? Search Costs and Local Activities. *Summer Institute of Competitive Strategy, UC Berkeley, July*.
49. Ghose, A., A. Goldfarb, and S. Han. 2011. How is the Mobile Internet Different? Search Costs and Local Activities. *Searle Research Symposium on the Economics and Law of Internet Search, Northwestern University, June*.
50. Ghose, A., A. Goldfarb, and S. Han. 2011. How is the Mobile Internet Different? Search Costs and Local Activities. *Statistical Challenges in E-Commerce Research (SCECR), University of Arizona, June*.
51. Chan, J., A. Ghose. 2011. Examining the Antecedents and Consequences of Disclosing Medical Privacy Information Online. *Winter Conference on Business Intelligence, University of Utah, Salt Lake City, March*.
52. Ghose, A., A. Goldfarb, and S. Han. 2010. Search Costs and Benefits on the Mobile Internet: An Empirical Analysis of Microblogging Behavior. *Workshop on Information Systems and Economics (WISE), St. Louis, December*.
53. Huang, Y., P. Singh, and A. Ghose. 2010. An Empirical Analyses of Dynamics in Enterprise Social Media. *Workshop on Information Systems and Economics (WISE), St. Louis, December*.

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54. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content. *NBER IT Economics & Productivity Workshop, Boston, July.*
55. Ghose, A., and S. Han. 2010. A Dynamic Structural Model of User Learning in Mobile Media Content. *Stanford Institute of Theoretical Economics (SITE), Stanford University, July.*
56. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content. *Marketing Science Conference, Cologne, June.*
57. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content. *Searle Research Symposium on the Economics and Law of Internet Search, Northwestern University, June.*
58. Ghose, A., P. Ipeirotis, and B. Li. 2010. Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content. *Customer Insights Conference, Yale University, May.*
59. Ghose, A., and S. Han. 2009. A Dynamic Structural Model of User Learning in Mobile Media Content. *MSI-WIMI Conference, University of Pennsylvania, Philadelphia, December.*
60. Ghose, A., and S. Han. 2009. A Dynamic Structural Model of User Learning in Mobile Media Content, *SIEPR-Microsoft Conference, Stanford University, September.*
61. Ghose, A., and S. Han. 2009. A Dynamic Structural Model of User Learning in Mobile Media Content. *INFORMS Marketing Science Conference, Ann Arbor, Michigan, June.*
62. Combining Text mining with Econometrics: Monetization of User-Generated Content and Online Advertising. *CITI Conference on User-Generated Content 3.0, Columbia University, April.*
63. Ghose, A., and S. Yang. 2009. Modeling and Estimating the Relationship Between Paid and Organic Search Advertising. *Conference on the Economics of Software & Internet Industries, Toulouse, January.*
64. Ghose, A., and S. Yang. 2008. Organic vs. Paid Search Advertising. *Workshop on Information Systems and Economics (WISE), Paris, December.*
65. Ghose, A., and S. Yang. 2008. Modeling and Estimating the Relationship Between Paid and Organic Search Advertising. *FTC and North-Western Microeconomics Conference, Washington DC, November.*
66. The Dimensions of Reputation in Electronic Markets, *INFORMS Annual Meeting, Washington DC, October.*
67. Ghose, A., and S. Yang. 2008. An Empirical Analysis of Sponsored Search Performance in Search Engine Advertising. *International Industrial Organization Conference, Washington DC, May.*
68. Ghose, A., and S. Yang. 2008. An Empirical Analysis of Sponsored Search Performance in Search Engine Advertising, *Research Frontiers in Marketing Science Conference, University of Texas at Dallas, February.*
69. Ghose, A., and S. Yang. 2008. An Empirical Analysis of Search Engine Advertising: Sponsored Search and Cross-Selling in Electronic Markets, *Leveraging Online Media and Online Marketing, Marketing Science Institute. February.*
70. Ghose, A., and S. Yang. 2007. An Empirical Analysis of Sponsored Search Performance in Search Engine Advertising, *Workshop on Information Systems and Economics (WISE 2007), December.*
71. Ghose, A., and P. Ipeirotis. 2007. Designing Novel Review Ranking Systems: Predicting Usefulness and Impact of Reviews. *Proceedings of the Ninth International Conference on Electronic Commerce (ICEC), Minnesota, August.*
72. Ghose, A., and S. Yang. 2007. An Empirical Analysis of Paid Placement in Online Keyword Advertising. *Proceedings of the Ninth International Conference on Electronic Commerce (ICEC), Minnesota, August.*
73. Ghose, A., M. Smith, and R. Telang. 2007. Internet Exchanges for Used Books: An Empirical



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- Analysis of Product Cannibalization and Welfare Implications. *Conference on Operational Excellence in Retailing*, Harvard Business School, June.
74. Ghose, A., and P. Ipeiroitis. 2007. Designing Novel Review Ranking Systems on the Web: Combining Economics with Opinion Mining. *Third Research Symposium on Statistical Challenges in E-Commerce Research (SCECR)*, University of Connecticut, May.
75. Ghose, A., and O. Yao. 2007. Goodbye Price Dispersion? New Evidence from Transaction Prices in Electronic Markets. *Third Research Symposium on Statistical Challenges in E-Commerce Research (SCECR)*, University of Connecticut, May.
76. Forman, C., A. Ghose, and A. Goldfarb. 2007. Geography and Ecommerce: Measuring Convenience, Selection and Price. *International Industrial Organization Conference*, Savannah, April.
77. Archak, N., A. Ghose, and P. Ipeiroitis. 2007. Towards Automating the Pricing Power of Product Attributes: An Analysis of Online Product Reviews. *Winter Business Intelligence Conference*, Utah, February.
78. Forman, C., A. Ghose, and A. Goldfarb. 2007. Geography and Ecommerce: Measuring Convenience, Selection and Price. *DIS Workshop*, University of Florida, January.
79. Ghose, A., and P. Ipeiroitis. 2007. Designing Trusted Ranking Systems for Consumer Reviews: Combining Economics with Opinion Mining. *DIMACS Workshop on Economics of Information Security*, Rutgers University, January.
80. Ghose, A., and P. Ipeiroitis. 2007. Designing Ranking Systems for Consumer Reviews: The Economic Impact of Customer Sentiment in Electronic Markets. *Proceedings of the 2007 International Conference on Decision Support Systems (ICDSS 2007)*, IIM Kolkata, January.
81. Forman, C., A. Ghose, and A. Goldfarb. 2007. Geography and Ecommerce: Measuring Convenience, Selection and Price. *HICSS 20th Anniversary Symposium on Competitive Strategy, Economics, and Information Systems*, Hawaii, January.
82. Ghose, A., and B. Gu. 2006. Estimating Menu Costs in Electronic Markets. *International Symposium on Information Systems (ISIS 2006)*, India, December.
83. Ghose, A., P. Ipeiroitis, and A. Sundararajan. 2006. The Dimensions of Reputation in Electronic Markets. *International Symposium on Information Systems (ISIS 2006)*, India, December.
84. Forman, C., A. Ghose, and A. Goldfarb. 2006. The Impact of Geographical Location on Consumer Use of Electronic Markets. *International Symposium on Information Systems (ISIS 2006)*, India, December.
85. Ghose, A., and B. Gu. 2006. Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets. *Workshop on Information Systems and Economics (WISE 2006)*, Northwestern University, Evanston, December.
86. Ghose, A., T. Mukhopadhyay, and U. Rajan. 2006. Impact of Internet Referral Services on the Supply Chain. *INFORMS Annual Meeting*, Pittsburgh, Pennsylvania, November.
87. Ghose, A., and B. Gu. 2006. Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets. *INFORMS Annual Meeting*, Pittsburgh, Pennsylvania, November.
88. Ghose, A., K. Huang, and A. Sundararajan. 2006. Versions and Successive Generations: An Analysis of Product Line Strategies and Cannibalization in Software Markets. *INFORMS Annual Meeting*, Pittsburgh, Pennsylvania, November.
89. Ghose, A., and O. Yao. 2006. Price Dispersion on the Internet: New Evidence from Transaction Prices in B2B Electronic Markets. *INFORMS Annual Meeting*, Pittsburgh, Pennsylvania, November.
90. Forman, C., A. Ghose, and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. *INFORMS Annual Meeting*, Pittsburgh, Pennsylvania, November.
91. Ghose, A. 2006. Information Uncertainty in Electronic Markets: An Empirical Analysis of Trade Patterns and Adverse Selection. *Proceedings of ZEW Workshop on ICT*, Germany, October.

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92. Ghose, A., and K. Huang. 2006. Personalized Pricing and Quality Design. *INFORMS Marketing Science Conference, Pittsburgh, Pennsylvania, June.*
93. Forman, C., A. Ghose, and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. *INFORMS Marketing Science Conference, Pittsburgh, Pennsylvania, June.*
94. Ghose, A., and B. Gu. 2006. Measuring Menu Costs of Online Retailers. *INFORMS Marketing Science Conference, Pittsburgh, Pennsylvania, June.*
95. Forman, C., A. Ghose, and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. *Conference on Operational Excellence in Retailing. Wharton School, June.*
96. Ghose, A., P. Ipeiroitis, and A. Sundararajan. 2006. The Dimensions of Reputation in Electronic Markets. *Decision and Information Sciences Workshop, University of Florida, February.*
97. Ghose, A., P. Ipeiroitis, and A. Sundararajan. 2006. The Dimensions of Reputation in Electronic Markets. *Statistical Challenges in E-Commerce Research (SCECR), University of Minnesota, May.*
98. Forman, C., A. Ghose, and A. Goldfarb. 2006. The Impact of Location on Consumer Purchases in Electronic Markets. *Statistical Challenges in E-Commerce Research (SCECR), University of Minnesota, May.*
99. Ghose, A., and B. Gu. 2006. Is Consumer Demand Kinked? Estimating Menu Costs and Search Costs in Electronic Markets. *Statistical Challenges in E-Commerce Research (SCECR), University of Minnesota, May.*
100. Ghose, A., and K. Huang. 2006. Personalized Pricing and Quality Design. *International Industrial Organization Conference, Boston, Massachusetts, April.*
101. Ghose, A., and K. Huang. 2005. Personalized Pricing and Quality Design. *Workshop on Information Systems and Economics (WISE 2005), UC Irvine, California, December.*
102. Ghose, A., and K. Huang. 2005. A Competitive Analysis of Personalized Pricing and Quality Customization. *Proceedings of the Workshop on CRM, New York University, November.*
103. Ghose, A., and A. Sundararajan. 2005. Pricing and Product Line Strategies for Software: Theory and Evidence. *INFORMS Annual Meeting, San Francisco, California, November.*
104. Ghose, A., M. Smith, and R. Telang. 2005. Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications. *INFORMS Annual Meeting, San Francisco, California, November.*
105. Ghose, A. 2005. Used Good Trade and Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets. *INFORMS Annual Meeting, San Francisco, California, November.*
106. Ghose, A., and A. Sundararajan. 2005. Pricing and Product Line Strategies for Software: Theory and Evidence. *Statistical Challenges in E-Commerce Research (SCECR), University of Maryland, College Park, May.*
107. Ghose, A., M. Smith, and R. Telang. 2005. Product Cannibalization and Welfare Implications. *Statistical Challenges in E-Commerce Research (SCECR), University of Maryland, College Park, May.*
108. Gal-Or, E., and A. Ghose. 2005. The Economic Consequences of Sharing Security Information. *International Industrial Organization Conference, Atlanta, Georgia, April.*
109. Ghose, A., M. Smith, and R. Telang. 2005. Internet Exchanges for Used Books: Welfare Implications and Policy Issues. *International Industrial Organization Conference, Atlanta, Georgia, April.*
110. Ghose, A., R. Telang, and R. Krishnan. 2004. Impact of Electronic Secondary Markets on Information Goods Suppliers. *Workshop on Information Systems and Economics (WISE 2004), College Park, Maryland, December.*
111. Ghose, A., M. Smith, and R. Telang. 2004. Internet Exchanges for Used Books: An Empirical Analysis of Welfare Implications and Policy Issues. *INFORMS Annual Meeting, Denver, Colorado,*

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### **October.**

112. Ghose, A., M. Smith, and R. Telang. 2004. Internet Exchanges for Used Books: An Empirical Analysis of Welfare Implications and Policy Issues. *MISRC/CRITO Symposium on the Digital Divide, Minneapolis, Minnesota, August.*
113. Ghose, A., T. Mukhopadhyay, and U. Rajan. 2003. Strategic Benefits of Internet Referral Services. *International Conference on Electronic Commerce (ICEC 2003), Pittsburgh, October.*
114. Ghose, A., R. Telang, and R. Krishnan. 2003. Durable Goods Competition in Secondary Electronic Markets. *INFORMS Marketing Science Conference, College Park, University of Maryland, June.*
115. Ghose, A., T. Mukhopadhyay, and U. Rajan. 2002. Strategic Benefits of Internet Referral Services. *Workshop on Information Systems and Economics (WISE 2002), Barcelona, Spain, December.*
116. Ghose, A., V. Choudhary, T. Mukhopadhyay, and U. Rajan. 2001. Dynamic Pricing on the Internet *Workshop on Information Systems and Economics (WISE 2001), New Orleans.*

### **RESEARCH GRANTS AND AWARDS**

- 2019 MSI Grant for “The Effect of Voice AI on Consumer Purchase and Search Behavior,” (with Chenshuo Sun, June Shi, and Xiao Liu), \$8,000.
- 2019 MSI Grant for “Demand Effects of the Internet-of-Things Channel,” (with Vilma Todri and Panos Adamopoulos), \$9,000.
- 2018 MSI Grant for “Using Artificial Intelligence to Automate Online-Offline Data Merger for Integrated Marketing,” (with Chenshuo Sun and Xiao Liu), \$6,500.
- 2016 NSF Grant for “Towards Building a Living Lab for mHealth Analytical and Behavioral Research using Internet of Things,” (with B. Li), \$230,000.
- 2015 Adobe Faculty Research Award for “Combining Machine Learning with Randomized Field Experiments to Improve Mobile Advertising,” (with B. Li) \$ 50,000.
- 2015 NET Institute Grant for “Towards Digital Attribution,” (with V. Todri), \$3,000.
- 2014 Wharton Customer Analytics Institute Award (with V. Todri, P. Adamapolous and P.V. Singh)
- 2014 Kauffman Grant for “Crowd funding Dynamics and its Impact on Entrepreneurial Landscape Empirical Analysis using Big Data,” (with G. Burtch and S. Wattal), \$30,000.
- 2013 Google Faculty Research Award for “Mobile Analytics in the New Mobile Economy,” \$66,500.
- 2012 Marketing Science Institute Grant for “Apps and Advertising in the Mobile Economy,” \$15,000.
- 2012 SEI-Wharton Future of Advertising Grant for “Innovative Approaches to Measuring Advertising Effectiveness,” with (S. Han), \$6,000.
- 2012 Institute on Asian Consumer Insights (ACI) Grant for “Mobile Ad Effectiveness and App Adoption in Asian Markets,” \$30,000.
- 2012 Google Faculty Research Award for “Designing Ranking Systems for Product Search Engines,” (With P. Ipeirotis), \$60,000.
- 2012 NET Institute Grant for “Impact of Internet Intermediaries on Spread of STDs,” (with J. Chan), \$7,000.
- 2012 NYU Abu Dhabi Institute Seed Grant (with V. Dhar, N. Memon, H. Nissenbaum and R. Karri).
- 2010 NSF IGERT Research and Education Program (with R. Karri, N. Menon, H. Nissenbaum, and R. Zimmerman), \$2.9 million.
- 2010 MSI-Wharton Interactive Media Initiative (WIMI) Grant for “Modeling Consumer Behavior in Social Media: Analyzing the Role of Geographical Location and Multichannel Usage in Microblogging Platforms,” (with S. Han), \$10,000.

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- 2010 Wharton Interactive Media Initiative (WIMI) Grant for “Modeling and Examining the Interdependence between Search and Display Advertising,” (with A. Goldfarb and S. Bae), \$5,000.
- 2010 Google-WPP Marketing Research Award for “Modeling The Dynamics Of Consumer Behavior In Mobile Advertising And Mobile Social Networks,” \$75,000.
- 2009 NSF Federal Cyberservice SFS Grant for “ASPIRE: An SFS Program for Interdisciplinary Research and Education” (co-PI with N. Menon, H. Nissenbaum, R. Karri, and R Zimmerman), \$2.12 million.
- 2009 NYU Stern Center for Japan-US Business and Economics Studies Grant for “The Economic Value of User-Generated Multimedia Content: A Study of the Mobile Media Market in South Korea,” \$10,000.
- 2009 NET Institute Summer Grant for “A Structural Model of User Learning and Dynamics in Mobile Media Content,” (with S. Han).
- 2009 MSI-Wharton Interactive Media Initiative (WIMI) Grant for “The Economic Impact of User-Generated Content: Combining Text mining with Demand Estimation in the Hotel Industry,” (with P. Ipeirotis), \$ 6,500.
- 2009 MSI-Wharton Interactive Media Initiative Grant for “User Content Generation and Usage in Digital Media,” (with S. Han), \$ 6,500.
- 2009 NYU-Poly Research Grant for “The Economics of User-Generated Content in Online Social Media,” (with V. Dhar and K. Ross), \$73,500.
- 2008 NET Institute Summer Grant for “Impact of Product Attributes and Geography in Search Engine Advertising”
- 2007 Marketing Science Institute Grant for “An Empirical Analysis of Search Engine Advertising,” (with S. Yang), \$10,000.
- 2007 NET Institute Summer Grant for “An Empirical Analysis of Sponsored Search in Online Advertising,” (with S. Yang).
- 2007 NET Institute Summer Grant for “Using Text Analytics to Estimate the Economic Value of Online Product Reviews: An Empirical Analysis,” (with P. Ipeirotis).
- 2007 Microsoft Virtual Earth Award for “Local Search for Hotels and Restaurants using Econometrics, Spatial Data, and Image Classification,” (with P. Ipeirotis), \$35,000.
- 2007 NSF CAREER Award, “Identifying and Measuring the Economic Value of Information on the Internet,” IIS-0643847, \$498,500.
- 2006 NYU Research Challenge Fund for “Consumer Use of Electronic Markets: An Empirical Analysis of New and Used Good Markets,” \$10,500.
- 2006 Microsoft Live Labs Award for “Combining Econometric and Text Mining Approaches for Measuring the Effect of Online Information Exchanges,” (with P. Ipeirotis) \$37,500.
- 2006 NET Institute Summer Grant for “Electronic commerce and Local Competition,” (with C. Forman and A. Goldfarb).
- 2006 NET Institute Summer Grant for “Search Costs and Menu Costs in Electronic Markets: Theory and Evidence,” (with B. Gu).
- 2005 NET Institute Summer Grant for “Used Good Trade and Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets,” \$10,500.
- 2005 NET Institute Summer Grant for “Pricing and Product Line Strategies for Consumer Software,” (with A. Sundararajan).
- 2003 Finalist, Third Annual e-BRC Doctoral Support Award Competition.



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**SELECTED INVITED PRESENTATIONS, PLENARY TALKS, AND KEYNOTES**

1. July 2024: How Academic Research Influences Global Litigations in Antitrust and Privacy, Seminar, HongKong University of Science and Technology
2. April 2024: Keynote Speech. Towards Building An AI-Based Organization: The Four Pillars Framework, IIM Americas Conference.
3. April 2024: How Academic Research Influences Global Litigations in Antitrust and Privacy, Seminar, University of Texas at Austin.
4. March 2024: Keynote. How Academic Research Influences Global Litigations in Antitrust and Privacy, Digital Economy Workshop, Erasmus University, Rotterdam.
5. December 2023. Mobile Health, Antitrust and Privacy, Seminar, Carnegie Mellon University.
6. October 2023. Mobile Health, Antitrust and Privacy, High Tower Seminar, Emory University.
7. September 2023: Keynote Speech. Towards Using AI to Improve Business and Society, World Knowledge Forum, Seoul.
8. August 2023: Keynote Speech. Building The Next Generation AI Organization: A Multi Pillar Framework, Estoril Conference, Lisbon, Portugal.
9. August 2023: Panelist. AI Unleashed, Estoril Conference, Lisbon, Portugal.
10. April 2023: Keynote Speech. Towards Building An AI-Based Organization: The Four Pillars Framework, Hi! Paris Conference, Paris, France.
11. January 2023. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. Seminar, Tulane University.
12. October 2022. Mobile Health, Antitrust and Privacy. Annual Marketing Camp, University of Connecticut.
13. September 2022. Mobile Health, Antitrust and Privacy. Seminar, University of Miami.
14. September 2022. Keynote Speech. Towards Building An AI-Based Organization: The Four Pillars Framework. World Knowledge Forum, Seoul, S. Korea.
15. August 2022. Keynote Speech. Towards Building An AI-Based Organization: The Four Pillars Framework. Data Driven Business, Sao Paulo, Brazil.
16. June 2022: Keynote Speech, Mobile Health, Antitrust and Privacy, National University of Singapore
17. May 2022. Keynote Speech, Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Workshop on Human-AI Interaction, American University.
18. April 2022: Keynote Speech, Monetizing Smartphone Data for Improving Business and Society, AIS India Chapter.
19. April 2022: Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. Seminar, Northwestern University, Kellogg.
20. April 2022: Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. Seminar, Annual Marketing Camp, Rice University.
21. February 2022. Monetizing Academic Research: Doing Research That Matters, IIT Kharagpur, India.
22. January 2022. Monetizing Smartphone Data for Improving Business and Society, IIM Calcutta, India.
23. December 2021. Keynote Speech. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment. 13th Annual Behavioral Operations Management Conference, China.
24. August 2021. Keynote Speech. Monetizing Smart Phone Data for Improving Business and Society. National University of Singapore Global Research Forum on Computational Social Science.
25. June 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Webinar, CVS-Aetna Keynote.

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26. April 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Webinar, IIM Udaipur.
27. February 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment, Webinar, Dartmouth College.
28. February 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Digital Leadership Series, Webinar, Boston University.
29. January 2021. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, Webinar, University of Georgia.
30. November 2020. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, University of British Columbia.
31. November 2020. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, University of Washington.
32. October 2020. Empowering Patients Using Smart Mobile Health Platforms: Evidence From A Randomized Field Experiment Webinar, Harvard Business School.
33. July 2020. Mobile Targeting Using Customer Trajectory Patterns, Webinar, IIM Ahmedabad.
34. May 2020. Technology in the Post Covid World, TEDX Gateway Webinar, TED.
35. May 2020. Mobile Targeting Using Customer Trajectory Patterns, Webinar, Virtual Digital Economy Seminar.
36. May 2020. Trading Privacy for the Greater Social Good: How Did America React During COVID-19. Carlson School MIS Online Seminar.
37. May 2020. Using AI, Tech and Data Science to Combat Health Pandemics, NetElixir Expert Series Webinar.
38. May 2020. Using AI, Tech and Data Science to Combat Health Pandemics, YPO Philippines-Asia Webinar Event.
39. April 2020. Using AI, Tech and Data Science to Combat Health Pandemics, NYU Stern Covid 19 Webinar Series.
40. December 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. AI Summit.
41. November 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Bengal Chamber of Commerce.
42. September 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Salesforce Executive Summit.
43. September 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. NetElixir X=Experience Conference.
44. August 2019. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. MBA Launch Summit. NYU Stern School.
45. July 2019 Keynote Speech. Digital Marketing Analytics. Big Data and Business Analytics Conference, Harbin, China.
46. June 2019 Keynote Speech. Winning in Omni-Channel Retail. Future of Retail Conference, Montreal.
47. May 2019 Plenary Speech. Legal Applications of Digital Marketing, Harvard Law School, Boston.
48. March 2019 Keynote Speech. Winning in Omni-Channel Retail. Aldar Group, Abu Dhabi, UAE.
49. March 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Big Data and Business Analytics Conference, Lagos, Nigeria.
50. February 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. CEO Summit Latin America, Miami.
51. February 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Jack

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- List, Osaka, Japan.
52. February 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Deloitte Consulting Conference, Tokyo, Japan.
  53. January 2019 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Japanese Marketing Association, Tokyo, Japan.
  54. October 2018 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. MMA Innovate, Mobile Marketing Association, NYC.
  55. September 2018 Plenary Speech. Using AI and Blockchain to Monetize the Mobile Economy. MSI Immersion, Boston, September 2018.
  56. August 2018 Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Melbourne Business Analytics Conference, Melbourne, Australia.
  57. July 2018 Keynote Speech. Digital Marketing Analytics. Big Data and Business Analytics Conference, Harbin, China, July 2018.
  58. June 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Harvard Club of New York.
  59. May 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Peking University's Guanghua School of Management, New York.
  60. May 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. ZEEMELT 2018, Mumbai.
  61. May 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Yale University, Center for Customer Insights.
  62. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Beijing, Plug and Play.
  63. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Peking University, Beijing.
  64. April 2018. Using AI and Blockchain to Monetize the Mobile Economy. ZAOJIU Talk, Shanghai.
  65. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Institute of Internet Industry, Tsinghua University, Beijing.
  66. April 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Shanghai National Accounting Institute, Shanghai.
  67. March 2018. Keynote Speech. Using AI and Blockchain to Monetize the Mobile Economy. Donga Business Review Forum, Seoul, South Korea.
  68. January 2018. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Indian School of Management & Entrepreneurship, Mumbai.
  69. January 2018. Plenary Panelist. Ethics and Artificial Intelligence. National Retail Federation Conference, New York.
  70. December 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Digital Leadership Summit, Seoul.
  71. December 2017. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Tel Aviv University, Israel.
  72. December 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Korea Internet Corporation Association, Seoul.
  73. November 2017. Fireside Chat. Artificial Intelligence and Education. Leverage Edu, New Delhi.
  74. November 2017. Plenary Speech. Artificial Intelligence and the Mobile Economy. Thinkers50 Conference, London.
  75. October 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Masters



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- and Business Conference, Singularity University, Poland
76. October 2017. Keynote Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Ignite Conference, University of Minnesota.
  77. September 2017. Plenary Speech. Using Artificial Intelligence to Unlock the Mobile Economy. Behavioral Economics in Action Research, University of Toronto.
  78. August 2017. Speech. Using Artificial Intelligence to Unlock the Mobile Economy, London.
  79. July 2017. Keynote Speech. Big Data and Business Analytics Summer Conference, Harbin.
  80. July 2017. Plenary Speech. TAP: Unlocking the Mobile Economy. Yello Mobile Digital Marketing Group, Seoul.
  81. July 2017. Plenary Speech. TAP: Unlocking the Mobile Economy. KP Financial Services Group, Seoul.
  82. June 2017. Keynote Speech. TAP: Unlocking the Mobile Economy. Innovation Connect Economy Conference, Singapore.
  83. June 2017. Keynote Speech. TAP: Unlocking the Mobile Economy. WPP-J. Walter Thompson Digital Conference, Shanghai.
  84. May 2017. Plenary Speech. TAP: Unlocking the Mobile Economy. CKGSB Knowledge Series, NYC.
  85. January 2017. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, University of Miami.
  86. December 2016. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Cornell University, Ithaca.
  87. November 2016. Keynote Speech. Towards Revolutionizing New Frontiers in Mobile Marketing. CTAM Think, Annual Meeting, New York.
  88. September 2016. Plenary Speech. Towards Revolutionizing New Frontiers in Mobile Marketing. Teradata PARTNERS Conference, Atlanta.
  89. July 2016. Keynote Speech. Data Analytics in Digital Marketing, Harbin Institute of Technology, China.
  90. June 2016. Plenary Speaker. Organization of Economic Cooperation and Development (OECD) Annual Meetings, Paris. Title: "Data and Algorithms."
  91. April 2016. Keynote Speech. Revolutionizing Mobile Marketing Using Data Science, Philips Behavioral Analytics Summit, Eindhoven, The Netherlands.
  92. April 2016. Keynote Speech. Revolutionizing Mobile Marketing Using Data Science, Latent View Conference, Chicago.
  93. February 2016. Plenary Speech. New Frontiers in Mobile Marketing Analytics, Personalizationpalooza, New York.
  94. February 2016. Plenary Speech. Towards Revolutionizing New Frontiers in Mobile Marketing Using Data Science, MSI Conference, New York.
  95. February 2016. Plenary Speech. Using New Media in Islamic Banking, International Forum on Islamic Finance, Khartoum, Sudan.
  96. February 2016. Keynote Speech. A Social Media and Digital Marketing Strategy for Banks, Bank of Khartoum, Sudan.
  97. November 2015. Keynote Speech. Business Alliance: IT & Marketing Analytics, Milan.
  98. October 2015. Keynote Speech, Towards Revolutionizing New Frontiers in Mobile Marketing Using Data Science, Digital Big Data, Smart Life & Mobile Marketing Analytics, New York.
  99. October 2015. Plenary Panelist, Consumer Analytics Using Wearable and Mobile Technologies, Association of Consumer Research Roundtable, New Orleans.
  100. October 2015. Keynote Speech. Using Randomized Field Experiments to Measure Mobile Marketing

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- Effectiveness, Unleashing Data Summit: Innovations in Marketing, Research, Insights and Branding, New York.
101. September 2015. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Yale China India conference, New York.
  102. September 2015. Invited Speaker. Measuring the Effectiveness of Mobile Marketing: Evidence from Multiple Field Experiments, Georgia State University, Atlanta.
  103. September 2015. Plenary Speech. MIXX Canada, Interactive Advertising Bureau of Canada, Toronto.
  104. August 2015 Keynote Speech. Crowdfunding in the Digital Economy, NYU Stern MBA Class of 2017, New York.
  105. June 2015. Keynote Speech. Harvard Business Review, Latin America Conference, Sao Paulo, Brazil. Title: "Big Data and Analytics."
  106. June 2015. Keynote Speech. Data Analytics in Digital Marketing, Harbin Institute of Technology, China.
  107. June 2015. Plenary Speaker. Organization of Economic Cooperation and Development (OECD) Annual Meetings, Paris. Title: "The New Production Revolution."
  108. June 2015. Invited Speaker. ESSEC Business School. Title: "Randomized Field Experiments in Mobile Marketing."
  109. June 2015. Invited Speaker. HEC. Title: "Randomized Field Experiments in Mobile Marketing."
  110. May 2015. Invited Speaker. University of Minnesota. Title: "Randomized Field Experiments in Mobile Marketing."
  111. May 2015. Invited Speaker. Adobe, San Jose. Title: "Combining Machine Learning With Randomized Field Experiments in Mobile Marketing."
  112. May 2015. Invited Speaker. Stanford University. Title: "Randomized Field Experiments in Mobile Marketing."
  113. May 2015. Invited Speaker. John Hopkins University. Title: "Randomized Field Experiments in Mobile Marketing."
  114. April 2015. Invited Speaker. Rotman School (Marketing), University of Toronto. Title: "Randomized Field Experiments in Mobile Marketing."
  115. April 2015. Invited Speaker. KAIST University, Seoul. Title: "Randomized Field and Natural Experiments in Mobile Marketing."
  116. February 2015. Invited Speaker. University of British Columbia. Title: "Randomized Field and Natural Experiments in Mobile Marketing."
  117. February 2015. Invited Speaker. Arizona State University. Title: "Randomized Field and Natural Experiments in Mobile Marketing."
  118. February 2015. Plenary Speech. Big Data Summit, Toronto.
  119. December 2014. Keynote Speech. NYCE Day. Title: "Randomized Field Experiments in Mobile Marketing."
  120. November 2014. Invited Speaker, David Eccles School of Business (Marketing), University of Utah, Title: "Randomized Field Experiments in Mobile Marketing."
  121. June 2014. Keynote Speech. Start-Up Grind, Shanghai. Title: "Big Data=Big Value."
  122. June 2014. Keynote Speech. BTO Conference, Milan, Italy. Title: "Leveraging Mobile for Digital Innovation."
  123. June 2014. Invited Speaker. Milan, Italy. Title: "Innovations in Mobile Marketing."
  124. May 2014. Invited Speaker, Foster School of Business (Marketing), University of Washington, Seattle. Title: "Analyzing the Interdependence between Web and Mobile Advertising: A Randomized Field Experiment."

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125. April 2014. Invited Speaker. KAIST University, Seoul. Title: "Randomized Field Experiments in Mobile Marketing."
126. March 2014: Keynote Speech. Workshop on Social & Business Analytics, University of Texas, Austin. Title: "Big Data, Randomized Field Experiments and Mobile Marketing Analytics."
127. December 2013. Keynote Speech. BTO Conference, Milan, Italy. Title: "Leveraging Mobile for Digital Innovation."
128. November 2013. Keynote Speech. Future of Business Event, NYU Stern. Title: "Using Big Data to Leverage The Mobile Consumer."
129. November 2013. Panel Moderator. Stern Graduate Marketing Association, NYU. Title: "Solving the Digital Equation."
130. October 2013. Plenary Speech. eBeverage Conference. Denver. Title: "Big Data and Mobile Analytics."
131. October 2013. Keynote Speech. Data Science and Big Data Initiative, Charlotte. Title: "Using Big Data to Leverage The Mobile Consumer." September 2013. Keynote Speech. NYU Stern Alumni, New York. Title: "Using Big Data to Leverage the Mobile Consumer."
132. September 2013. Plenary Speech. NYC Media Lab Research Summit, New York. Title: "Tapping into Crowd funding."
133. August 2013. Keynote Speech. Digital Summit, Hyderabad. "Mobile Economy and Location-Based Marketing."
134. August 2013. Keynote Speech. MBA Launch Summit. NYU Stern School. Title: "Technology, Innovation, and the Role of Business in Society."
135. August 2013. Keynote Speech. Undergraduate Orientation. NYU Stern School. Title: "Technology, Innovation, and the Role of Business in Society."
136. June 2013. Keynote Speech. E-Metrics Conference, Chicago. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
137. May 2013. Plenary Panelist. The Economist Innovation Forum Conference, San Francisco. Title: "Mind the Gap: Resolving the Skills Gap in Data Analytics."
138. May 2013. Invited Speaker. Innovative Approaches to Measuring Advertising Effectiveness Conference, Wharton School. Title: "Analyzing the Interdependence Between Web and Mobile Advertising."
139. April 2013. Invited Speaker. ESSEC Business School, (Marketing). Paris. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
140. April 2013. Invited Speaker. Heinz School, Carnegie Mellon, Pittsburgh. Title: "Apps, Advertising, and Commerce in the New Mobile Economy."
141. March 2013. Invited Speaker. Cheung Kong Graduate School of Business, (Marketing). Beijing. Title: "Ranking Products on Search Engines."
142. March 2013. Invited Speaker. Fudan University, (Marketing). Shanghai. Title: "Ranking Products on Search Engines."
143. March 2013. Invited Speaker. Tsinghua University School of Economics and Management, (Marketing). Beijing. Title: "Ranking Products on Search Engines."
144. March 2013. Invited Speaker. Paul Merage School of Business, University of California, Irvine. Title: "Ranking Products on Search Engines."
145. February 2013. Invited Speaker. Lerner School of Business, University of Delaware, Newark. Title: "Ranking Products on Search Engines."
146. February 2013. Webinar. International Institute of Business Analysis. Title: "Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy."
147. January 2013. Plenary Speech. Minnesota Big Data Analytics Conference. University of Minnesota,

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- Minneapolis. Title: “Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy.”
148. January 2013. Plenary Speech. Advertising and Data Science Congress. NYU Stern. Title: “Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy.”
  149. January 2013. Invited Speaker. Boston University, Boston. Title: “Ranking Products on Search Engines.”
  150. December 2012. Invited Speaker. Harvard Business School (Marketing), Boston. Title: “Apps, Advertising, and Commerce in the New Mobile Economy.”
  151. December 2012. Invited Speaker. Big Data Conference. MIT, Boston. Title: “Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy.”
  152. December 2012. Invited Speaker. David Eccles School of Business. University of Utah. Title: “Apps, Advertising, and Commerce in the New Mobile Economy.”
  153. November 2012. Keynote Speech. Big Data and Business Analytics. BTO Conference, Rome, Italy.
  154. November 2012. Keynote Speech. Digital Marketing Summit, Indian School of Business. Title: “Mobile Analytics: Apps, Advertising, and Commerce in the New Mobile Economy.”
  155. October 2012. Plenary Speech. Orange Institute. Title: “Mobile Analytics.”
  156. October 2012. Invited Speaker. TED lecture series. TEDxNYU. Title: “Mobile Marketing Trends.”
  157. September 2012. Moderator. NYU Stern Center for Measurable Marketing. Panel on “Measurable Marketing in the Path to Purchase.”
  158. August 2012. Keynote Speech. Launch 2012. NYU Stern School. Title: “Technology, Innovation, and the Role of Business in Society.”
  159. May 2012. Plenary Speech. IBC Workshop, Institute of E-Commerce & Digital Markets (LMU) in Munich, Germany. Title: “Social Media and Digital Marketing Trends.”
  160. May 2012. Invited Speaker. London Business School (Marketing). Title: “London Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  161. April 2012. Invited Speaker. Korea University, Seoul. Title: “Apps, Advertising, and Commerce in the New Mobile Economy.”
  162. April 2012. Invited Speaker. University of Texas at Austin, Austin. Title: “Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  163. March 2012. Invited Speaker. Wharton School, Philadelphia. Title: “Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  164. March 2012. Keynote Speech. Allianz Group-CIO Conference, Milan, Italy. Title: “Outlook 2013: Social Media and Digital Marketing Trends.”
  165. March 2012. Plenary Speech. BTO Conference, Milan, Italy. Title: “Social Media and Digital Marketing Trends.”
  166. March 2012. Invited Speaker. University of Connecticut, Storrs. Title: “Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  167. February 2012. Moderator. Carlson School, University of Minnesota. Panel on “Leveraging Social Media for Business.”
  168. February 2012, Moderator. Stern in Africa Conference, NYU Stern. Panel on “Emerging Industries in Africa.”
  169. November 2011. Invited Speaker. UCLA (Economics), Los Angeles. Title “Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  170. November 2011. Invited Speaker. Michigan State, East Lansing. Title: “Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  171. October 2011. Invited Speaker. Harvard Business School, Boston. Title: “Interplay Between Search

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- and Social Media: Designing Ranking Systems for Search Engines.”
172. September 2011. Invited Speaker. University of Arizona, Tucson. Title: “Interplay Between Search and Social Media: Designing Ranking Systems for Search Engines.”
  173. August 2011. Keynote Speech. Launch 2011. NYU Stern School. Title: “Technology, Innovation, and the Role of Business in Society.”
  174. June 2011. Plenary Panelist. Statistical Challenges in Ecommerce Research (SCECR) conference, Rio De Janeiro, Brazil. Title: “Smart-Everything: Cyber Analytics Platforms and Real-Time Monitoring of the Real World.”
  175. May 2011. Plenary Panelist. NYU Stern Conference on Measurable Marketing in a Digital World. Title: “Cross Media Effectiveness Measurement.”
  176. May 2011. Invited Speaker. Rising Star Speaker Series, Case Western University. Cleveland. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  177. May 2011. Plenary Panelist. India World Conference, New York. Title “India’s IT Industry: The End of the Beginning.”
  178. May 2011. Invited Speaker. MIT (Sloan Marketing), Boston. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  179. April 2011. Invited Speaker. Columbia University (GSB Marketing), New York. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  180. April 2011. Invited Speaker. Seoul National University, Seoul. Title: “Designing Ranking Systems For Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  181. January 2011. Invited Speaker. MSI Young Scholar’s Conference, Utah. Title: “Search and Social Media in the Digital Economy: A Research Agenda.”
  182. December 2010. Plenary Panelist. Workshop on Information Systems and Economics, Phoenix, Arizona. Title: “Whither WISE.”
  183. October 2010. Invited Speaker. University of Maryland, College Park. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  184. October 2010. Invited Speaker. Distinguished Speaker Series, Georgia Tech, Atlanta, October. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  185. September 2010. Plenary Panelist. Workshop on Interdisciplinary Studies in Information Security and Privacy, Abu Dhabi. Title: “Privacy Issues in Social Media and Ecommerce.”
  186. September 2010. Invited Speaker. Harvard University (Economics), Boston. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  187. September 2010. Invited Speaker. George Mason University, Washington DC. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
  188. July 2010. Invited Speaker. NBER IT Economics & Productivity Workshop, Boston. Title: “Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.”
  189. July 2010. Invited Speaker. Stanford Institute of Theoretical Economics (SITE), Stanford University. Title: “A Dynamic Structural Model of User Learning in Mobile Media Content.”
  190. June 2010. Invited Speaker. Workshop on Digital Business Models, Paris. Title: “Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.”
  191. June 2010, Plenary Speech. L2 Mobile Commerce Clinic at NYU Stern. Title: “Mobile Trends,



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Consumers, and Social Media.”

192. April 2010. Invited Speaker. Temple University. Title: “Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.”
193. February 2010. Invited Tutorial. Carlson School. University of Minnesota. Title: “Structural Econometric Modeling: Static and Dynamic Models.”
194. February 2010. Invited Speaker. University of Minnesota. Title: “Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.”
195. September 2009. Invited Speaker. Internet Economics Conference, Stanford University. Title: “User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning.”
196. April 2009. Invited Speaker. Columbia University. Title: “Combining Text mining with Econometrics: Monetization of User-Generated Content and Online Advertising.”
197. April 2009. Invited Speaker. Microsoft Research, Boston. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
198. September 2009. Invited Speaker. Internet Economics Conference, Stanford University. Title: “User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning.”
199. April 2009. Invited Speaker. Columbia University. Title: “Combining Text mining with Econometrics: Monetization of User-Generated Content and Online Advertising.”
200. April 2009. Invited Speaker. Microsoft Research, Boston. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
201. April 2009. Invited Speaker. Heinz College, Carnegie Mellon University. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
202. March 2009. Invited Speaker. Wharton School, University of Pennsylvania. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
203. March 2009. Keynote Speech. Ecommerce and Banking 3.0 Conference, Frankfurt, Germany. Title: “User Generated Content and Monetization in the New Economy.”
204. March 2009. Invited Speaker. University of Goethe-Frankfurt. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
205. March 2009. Invited Speaker. University of Connecticut. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
206. February 2009. Invited Speaker. University of Calgary. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
207. February 2009. Invited Speaker. Purdue University. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
208. February 2009. Invited Speaker. University of California at Irvine. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
209. November 2008. Invited Speaker. University of Texas at Dallas. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
210. November 2008. Invited Speaker. Polytechnic University of NYU. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
211. November 2008. Invited Speaker. Speaker on the Square Series, NYU. Title: “User Generated Content, Panel on Technology in the Digital Age.”
212. October 2008. Invited Speaker. McGill University. Title: “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”
213. May 2008. Invited Speaker. University of Washington, Seattle. Title “Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets.”

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214. March 2008. Invited Speaker. IBM Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
215. February 2008. Invited Speaker. Yahoo Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
216. February 2008. Invited Speaker. Marketing Science Institute. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
217. November 2008. Invited Speaker. Speaker on the Square Series, NYU. Title: "User Generated Content, Panel on Technology in the Digital Age."
218. October 2008. Invited Speaker. McGill University. Title: "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
219. May 2008. Invited Speaker. University of Washington, Seattle. Title "Search Engine Advertising: Sponsored Search, Organic Search, and User-Generated Content in Electronic Markets."
220. March 2008. Invited Speaker. IBM Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
221. February 2008. Invited Speaker. Yahoo Research. Mining User-Generated Content Using Econometrics: A Case Study on Reputation Systems.
222. February 2008. Invited Speaker. Marketing Science Institute. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
223. November 2007. Invited Speaker. University of Minnesota, Minneapolis. Title: "The Dimensions Of Reputation in Electronic Markets."
224. June 2007. Invited Speaker. City University of Hong Kong. Title: "The Dimensions of Reputation In Electronic Markets."
225. June 2007. Invited Speaker. Hong Kong University of Science and Technology. Title: "The Dimensions of Reputation in Electronic Markets."
226. June 2007. Invited Speaker. Nanyang Business School, Singapore. Title: "The Dimensions of Reputation in Electronic Markets."
227. June 2007. Invited Speaker. Singapore Management University. Title: "The Dimensions of Reputation in Electronic Markets."
228. June 2007. Invited Speaker. National University of Singapore. Title: "The Dimensions of Reputation in Electronic Markets."
229. June 2007. Invited Speaker. Conference on Operational Excellence in Retailing. Harvard University (HBS). Title: "Internet Exchanges for Used Books: An Empirical Analysis of Product Cannibalization and Welfare Implications."
230. June 2007. Invited Speaker. Triennial Invitational Choice Symposium, Wharton School. Personalized Pricing and Quality Design.
231. February 2007. Invited Speaker. University of Texas at Austin. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
232. January 2007. Invited Speaker. University of Florida. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
233. November 2006. Invited Speaker. Moore School of Business, University of South Carolina. Geography and Ecommerce: Measuring Convenience, Selection, and Price.
234. November 2006. Invited Speaker. Marketing Lunchtime Seminar, NYU Stern School of Business. Title: "Geography and Ecommerce: Measuring Convenience, Selection, and Price."
235. June 2006. Invited Speaker. Conference on Operational Excellence in Retailing. Wharton School. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
236. April 2006. Invited Speaker. Drexel University. Title: "Personalized Pricing and Quality Design."
237. January 2006. Invited Speaker. Ohio State University. Title: "Internet Exchanges for Used Books: An



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- Empirical Analysis of Product Cannibalization and Welfare Implications.”
238. February 2004. Invited Speaker. University of Southern California. Title: “Impact of Internet Referral Services on the Supply Chain.”
  239. February 2004. Invited Speaker. University of Arizona. Title: “Impact of Internet Referral Services on the Supply Chain.”
  240. February 2004. Invited Speaker. University of Maryland at College Park. Title: “Impact of Internet Referral Services on the Supply Chain.”
  241. February 2004. Invited Speaker. University of California at Irvine. Title: “Impact of Internet Referral Services on the Supply Chain.”
  242. February 2004. Invited Speaker. Tulane University. Title: “Impact of Internet Referral Services on The Supply Chain.”
  243. February 2004. Invited Speaker. University of Connecticut. Title: “Impact of Internet Referral Services on the Supply Chain.”
  244. February 2004. Invited Speaker. New York University. Title: “Impact of Internet Referral Services on the Supply Chain.”
  245. January 2004. Invited Speaker. University of Alberta. Title: “Impact of Internet Referral Services on The Supply Chain.”

**SELECTED CONFERENCE PRESENTATIONS**

1. June 2023: Invited Speaker. Career Advice for Junior Scholars. INFORMS Marketing Science Doctoral Consortium, Miami.
2. August 2019. Invited Speaker. Title: AI and Blockchain in Marketing. Emory University Conference, Atlanta.
3. June 2019. Invited Speaker. Title: AI and Blockchain in Omni Channel Marketing. INFORMS Marketing Science Conference, Rome.
4. June 2019. Invited Speaker. Title: AI and Blockchain in Marketing. AMA Seth Annual Marketing Conference, New York.
5. June 2018. Invited Speaker. Title: Using AI and Blockchain in Marketing. INFORMS Marketing Science Conference.
6. October 2014. Invited Speaker, INFORMS Annual Conference, Thought Leader Series. Title: “Randomized Field Experiments in Mobile Marketing.”
7. May 2014. Conference Presentation. Crowds 2.0 Conference, NYU Stern School. Title: “Privacy Controls and Anonymity in Crowd funding.”
8. November 2013. Conference Presentation. Mapping Mobile Conference, NYU Stern School. Title: “Randomized Field Experiments to Measure ROI of Mobile Advertising and Mobile Coupons.”
9. June 2013. Conference Presentation. Marketing Science Conference, Istanbul. Title: “Estimating Cross Platform and Cross Device Synergies Between Web and Mobile Advertising.”
10. June 2011. Conference Presentation. Statistical Challenges in ecommerce Research (SCECR) conference, Rio De Janeiro, Brazil. Title: “How is the Mobile Internet Different?”
11. June 2011. Conference Presentation. ZEW Conference, Mannheim. Title: “Designing Ranking Systems for Hotels on Travel Search Engines By Mining User-Generated and Crowd-Sourced Content.”
12. June 2010. Conference Presentation. Marketing Science Conference, Cologne. Title: “Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.”
13. June 2010. Conference Presentation. Searle Research Symposium on the Economics and Law of Internet Search, Northwestern University. Title: “Estimating Demand in the Hotel Industry by Mining

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User-Generated and Crowd-Sourced Content.”

14. May 2010. Customer Insights Conference, Yale University. Conference Presentation. Title: “Estimating Demand in the Hotel Industry by Mining User-Generated and Crowd-Sourced Content.”
15. December 2009. Conference Presentation. Workshop on Information Technology and Systems (WITS), Phoenix. Title: “Towards Designing Ranking Systems for Hotels on Travel Search Engines: Combining Text mining with Demand Estimation in the Hotel Industry.”
16. December 2009. Conference Presentation. MSI-WIMI Conference, University of Pennsylvania, Philadelphia. Title: “User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning.”
17. August 2009. Conference Presentation. Marketing Dynamics Conference, NYU Stern, August. Title: “User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning.”
18. June 2009. Conference Presentation. Marketing Science Conference, University of Michigan, Ann Arbor. Title: “User Content Generation and Usage Behavior in Multi-Media Settings: A Dynamic Structural Model of Learning.”
19. January 2009. Conference Presentation. The Economics of the Internet and Software, Toulouse. Title: “Modeling and Estimating the Relationship Between Organic and Paid Search Advertising.”
20. December 2008. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: “Modeling and Estimating the Relationship Between Organic and Paid Search Advertising.”
21. December 2008. Conference Presentation. International Conference on Information Systems (ICIS), Paris. Market Frictions, Demand Structure and Price Competition in Online Markets.
22. December 2008. Conference Presentation. Workshop on Information Systems and Economics (WISE), Paris. Title: “Modeling and Estimating the Relationship Between Organic and Paid Search Advertising.”
23. December 2008. Conference Presentation. Workshop on Information Technology and Systems (WITS), Paris. An Empirical Analysis of Search Engine Advertising: Sponsored and Organic Search in Electronic Markets.
24. November 2008. Conference Presentation. Federal Trade Commission, Washington DC. Title: “Modeling and Estimating the Relationship Between Organic and Paid Search Advertising.”
25. October 2008. Conference Presentation. INFORMS Annual Meeting, Washington DC. Title: “The Dimensions of Reputation in Electronic Markets.”
26. October 2008. Conference Presentation. INFORMS CIST, Washington DC. Title: “Deriving the Pricing Power of Product Features by Mining User-Generated Reviews.”
27. August 2008. Conference Presentation. International Workshop on Data mining and Audience Intelligence for Advertising. ADKDD. Las Vegas. Title: “Comparing Performance Metrics in Organic Search with Sponsored Search Advertising.”
28. June 2008. Conference Presentation. Marketing Science Conference, Vancouver. Title: “An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets.”
29. May 2008. Conference Presentation. International Industrial Organization Conference, Washington DC. Title: “An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets.”
30. April 2008. Conference Presentation. NET Institute Conference, NYU. Title: “An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets.”
31. February 2008. Conference Presentation. ACM WSDM Conference, Stanford University. Title: “An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets.”
32. December 2007. Conference Presentation. International Conference on Information Systems (ICIS)

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- Montreal. Title: "Estimating Menu Costs in Electronic Markets."
33. December 2007. Conference Presentation. Workshop on Information Systems and Economics (WISE), Montreal. Title: "Towards Empirically Modeling Consumer and Firm Behavior in Sponsored Search Advertising."
  34. November 2007. Conference Presentation. Conference on Information Systems and Technology (CIST), Seattle. Title: "An Empirical Analysis of Search Engine Advertising: Sponsored Search in Electronic Markets."
  35. November 2007. Conference Presentation. INFORMS, Seattle. Title: "Examining the Relationship Between Reviews and Sales: The Role of Reviewer Identify Disclosure in Electronic Markets."
  36. August 2007. Conference Presentation. International Conference on Electronic Commerce (ICEC), Minnesota. Title: "Designing Novel Review Ranking Systems: Predicting Usefulness and Impact."
  37. August 2007. Conference Presentation. International Conference on Electronic Commerce (ICEC), Minnesota. Title: "An Empirical Analyses of Paid Placement in Online Keyword Advertising."
  38. May 2007. Conference Presentation. Statistical Challenges in E-Commerce. Title: "Designing Novel Review Ranking Systems on the Web: Combining Economics with Opinion Mining."
  39. April 2007. Conference Presentation. NET Institute Conference, New York University. Title: "Geography and Ecommerce: Measuring Convenience, Selection and Price."
  40. January 2007. Conference Presentation. DIMACS Workshop, Rutgers University. Title: "Designing Trusted Ranking Systems for Consumer Reviews: Combining Economics with Opinion Mining."
  41. January 2007. Conference Presentation. International Conference on Decision Support Systems (ICDSS), IIM Kolkata, India. Title: "Designing Ranking Systems for Consumer Reviews: The Economic Impact of Customer Sentiment in Electronic Markets."
  42. December 2006. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "Estimating Menu Costs in Electronic Markets."
  43. December 2006. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "The Dimensions of Reputation in Electronic Markets."
  44. December 2006. Conference Presentation. International Symposium on Information Systems (ISIS), ISB, Hyderabad. Title: "The Impact of Location on Consumer Use of Electronic Markets."
  45. December 2006. Conference Presentation. Workshop on Information Technology and Systems (WITS), Milwaukee. Title: "Towards an Understanding of the Impact of Customer Sentiment on Product Sales and Review Quality."
  46. December 2006. Conference Presentation. International Conference on Information Systems (ICIS), Milwaukee. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
  47. December 2006. Conference Presentation. Workshop on Information Systems and Economics (WISE), Northwestern University, Evanston. Title: "Search Costs, Demand Structure and Long Tail in Electronic Markets: Theory and Evidence."
  48. November 2006. Conference Presentation. INFORMS Annual Meeting, Pittsburgh. Title: "Impact of Internet Referral Services on the Supply Chain."
  49. November 2006. Conference Presentation. INFORMS Annual Meeting, Pittsburgh. Title: "Estimating Menu Costs in Electronic Markets."
  50. November 2006. Conference Presentation. INFORMS Annual Meeting, Pittsburgh. Title: "The Impact of Location on Consumer Purchases in Electronic Markets."
  51. November 2006. Conference Presentation. INFORMS Conference on Information Systems and Technology (CIST), Pittsburgh. Title: "Software Versioning and Quality Degradation? An Exploratory Study of the Evidence."
  52. October 2006. Conference Presentation. ZEW Conference on ICT, Mannheim. Title:

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- “Information Uncertainty in Electronic Markets: An Empirical Analysis of Trade Patterns and Adverse Selection.”
53. June 2006. Conference Presentation. Workshop on Economics and Information Security (WEIS), Cambridge University. Title: “The Economic Impact of Regulatory Information Disclosure on Information Security Investments, Competition, and Social Welfare.”
  54. June 2006. Conference Presentation. INFORMS Marketing Science Conference, Pittsburgh. Title: “Personalized Pricing and Quality Design.”
  55. May 2006. Conference Presentation. Statistical Challenges in E-Commerce Research, University of Minnesota. Title: “The Dimensions of Reputation in Electronic Markets.”
  56. April 2006. Conference Presentation. International Industrial Organization Conference, Boston. Title: “Personalized Pricing and Quality Design.”
  57. April 2006. Conference Presentation. NET Institute Conference, New York University. Title: “Used Good Trade and Adverse Selection in Electronic Secondary Markets.”
  58. March 2006. Conference Presentation. Impact of Internet Referral Services on the Supply Chain. ISR Workshop, University of Michigan at Ann Arbor.
  59. February 2006. Conference Presentation. University of Florida. Title: “The Dimensions of Reputation in Electronic Markets.”
  60. December 2005. Conference Presentation. International Conference on Information Systems (ICIS), Las Vegas. Title: “Software Versioning and Quality Degradation? An Exploratory Study of the Evidence.”
  61. December 2005. Conference Presentation. Workshop on Information Systems and Economics (WISE), UC Irvine, California. Title: “Personalized Pricing and Quality Design.”
  62. November 2005. Conference Presentation. Workshop on CRM, New York University. Title: “A Competitive Analysis of Personalized Pricing and Quality Customization.”
  63. November 2005. Conference Presentation. INFORMS Annual Meeting, San Francisco, California. Title: “Pricing and Product Line Strategies for Software: Theory and Evidence.”
  64. November 2005. Conference Presentation. INFORMS Annual Meeting, San Francisco, California. Title: “Used Good Trade and Adverse Selection: A Cross-Country Comparison of Electronic Secondary Markets.”
  65. June 2005. Conference Presentation. Workshop on Economics of Information Security, Harvard University, Boston. Title: “Pricing Security Software.”
  66. May 2005. Conference Presentation. Statistical Challenges in ecommerce Research. Maryland. Title: “Pricing and Product Line Strategies for Consumer Software: Evidence from Amazon.”
  67. April 2005. Conference Presentation. International Industrial Organization Conference. Atlanta. Title: “The Economic Incentives for Sharing Security Information.”
  68. January 2005. Conference Presentation. Hawaiian International Conference on System Sciences. Hawaii. Title: “Effect of Electronic Secondary Markets on the Supply Chain.”
  69. December 2004. Conference Presentation. Workshop on Information Systems and Economics (WISE). University of Maryland at College Park. Title: “Impact of Secondary Electronic Markets on Information Goods Suppliers.”
  70. December 2003. Conference Presentation. International Conference on Information Systems (ICIS). Seattle, WA. Title: “Durable Goods Competition in the Presence of Secondary E-Marketplaces.”
  71. December 2003. Conference Presentation. International Conference on Information Systems (ICIS). Seattle, WA. Title: “Internet Exchanges for Used Books: An Empirical Investigation into Welfare Implications and Policy Issues.”
  72. October 2003. Conference Presentation. International Conference on E-Commerce (ICEC). Pittsburgh, PA. Title: “Strategic Benefits of Internet Referral Services.”

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73. October 2003. Conference Presentation. Conference on Information Systems and Technology (CIST), Atlanta, GA. Title: "Dynamic Pricing: A Strategic Advantage for Electronic Retailers."
74. June 2003. Conference Presentation. Workshop on Economics of Information Security. University of Maryland at College Park. Title: "The Economic Incentives for Sharing Security Information."
75. December 2002. Conference Presentation. Workshop on Information Systems and Economics (WISE). Barcelona, Spain. Title: "Impact of Internet Referral Services on the Supply Chain."
76. December 2002. Conference Presentation. International Conference on Information Systems (ICIS). Barcelona, Spain. Title: "Dynamic Pricing: A Strategic Advantage for Internet Retailers."
77. November 2002. Conference Presentation. INFORMS Conference on Information Systems and Technology (CIST), San Jose. Title: "Impact of Referral Services on Channel Profits: Competition between Manufacturers and Info mediaries."

**TEACHING**

- MSBA: Digital Marketing Analytics, NYU Summer 2024. (Instructor Rating: 4.6/5)
- MBA: Digital Marketing Analytics, NYU Winter 2024. (Instructor Rating: 4.6/5)
- MBA: Digital Marketing Analytics, NYU Fall 2023. (Instructor Rating: 5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2023. (Instructor Rating: 4.7/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2023. (Instructor Rating: 4.9/5)
- MBA: Digital Marketing Analytics, NYU Winter 2023. (Instructor Rating: 4.9/5)
- MBA: Digital Marketing Analytics, NYU Summer 2022. (Instructor Rating: 4.9/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2022. (Instructor Rating: 4.74/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2022. (Instructor Rating: 4.4/5)
- MBA: Digital Marketing Analytics, NYU Winter 2022. (Instructor Rating: 4.7/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2021. (Instructor Rating: 4.75/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2021. (Instructor Rating: 4.9/5)
- MBA: Digital Marketing Analytics, NYU Winter 2021. (Instructor Rating: 4.5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2020. (Instructor Rating: 4.7/5)
- MBA: Digital Marketing Analytics, NYU Summer 2020. (Instructor Rating: 4.5/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2020. (Instructor Rating: 4.6/5)
- MBA: Digital Marketing Analytics, NYU Fall 2019. (Instructor Rating: 4.8/5)
- MBA: Digital Marketing Analytics, NYU Summer 2019. (Instructor Rating: 4.8/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2019. (Instructor Rating: 4.8/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2019. (Instructor Rating: 4.8/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2018. (Instructor Rating: 4.7/5)
- MBA: Digital Marketing Analytics, NYU Summer 2018. (Instructor Rating: 4.6/5)
- EMBA: Digital Marketing Analytics, NYU Spring 2018. (Instructor Rating: 4.8/5)
- MBA: Digital Marketing Analytics, NYU Fall 2017. (Instructor Rating: 6.8/7)
- MBA: Digital Marketing Analytics, NYU Summer 2017. (Instructor Rating: 6.7/7)
- MSBA: Digital Marketing Analytics, NYU Summer 2017. (Instructor Rating: 6.6/7)
- EMBA: Digital Marketing Analytics, NYU Spring 2017. (Instructor Rating: 6.8/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2016. (Instructor Rating: 6.7/7)
- MBA: Digital Marketing Analytics, NYU Fall 2016. (Instructor Rating: 6.8/7)



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- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2016. (Instructor Rating: 6.5/7)
- MBA: Digital Marketing Analytics, NYU Summer 2016. (Instructor Rating: 6.6/7)
- MSBA: Digital Marketing Analytics, NYU Summer 2016. (Instructor Rating: 6.4/7)
- EMBA: Digital Marketing Analytics, NYU Spring 2016. (Instructor Rating: 6.6/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2015. (Instructor Rating: 6.7/7)
- MBA: Digital Marketing Analytics, NYU Summer 2015. (Instructor Rating: 6.6/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2015. (Instructor Rating: 6.5/7)
- TRIUM MBA: Social Media & Digital Marketing Analytics, NYU Fall 2015. (Instructor Rating: 4.5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2015. (Instructor Rating: 6.6/7)
- EMBA: Social Media and Digital Marketing Analytics, NYU Spring 2015. (Instructor Rating: 6.4/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2014. (Instructor Rating: 6.8/7)
- TRIUM MBA: Social Media & Digital Marketing Analytics, NYU Fall 2014. (Instructor Rating: 4.5/5)
- MSBA: Digital Marketing Analytics, NYU Summer 2014. (Instructor Rating: 6.9/7)
- MBA: Digital Marketing Analytics, NYU Summer 2014. (Instructor Rating: 6.3/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2014. (Instructor Rating: 6.9/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Fall 2013. (Instructor Rating: 6.7/7)
- EMBA: Social Media and Digital Marketing Analytics, NYU Spring 2014. (Instructor Rating: 6.85/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2013. (Instructor Rating: 6.7/7)
- MSBA: Social Media and Digital Marketing Analytics, NYU Fall 2013. (Instructor Rating: 6.8/7)
- TRIUM MBA: Social Media & Digital Marketing Analytics, NYU Fall 2013. (Instructor Rating: 3.9/5)
- MBA: Social Media and Digital Marketing Analytics, NYU Summer 2013. (Instructor Rating: 6.5/7)
- Exec Ed: Leveraging Social Media and Digital Marketing, Spring 2013. (Instructor Rating: 6.0/7)
- MBA: Social Media and Digital Marketing Analytics, NYU Fall 2012. (Instructor Rating: 6.0/7)
- UG: Social Media and Digital Marketing Analytics, NYU Fall 2012. (Instructor Rating: 6.2/7)
- UG: IT in Business & Society: UG Core, NYU Fall 2010. (Instructor Ratings: 6.5/7, 6.6/7)
- UG: Electronic Commerce and Social Media: NYU Fall 2009. (Instructor Rating: 6.0/7)
- UG: IT in Business & Society: UG Core, NYU Fall 2008. (Instructor Ratings: 6.6/7, 6.7/7)
- UG: Electronic Commerce: UG Elective, NYU Fall 2008. (Instructor Rating: 6.6/7)
- UG: IT in Business & Society: UG Core, NYU Fall 2007. (Instructor Ratings: 6.6/7, 6.7/7)
- UG: Electronic Commerce: UG Elective, NYU Fall 2007. (Instructor Rating: 6.8/7)
- UG: IT in Business & Society: UG Core, NYU Fall 2006. (Instructor Ratings: 6.8/7, 7/7)
- UG: Electronic Commerce: UG Elective, NYU Fall 2006. (Instructor Rating: 6.7/7)
- UG: IT in Business & Society: UG Core, NYU Fall 2005. (Instructor Ratings: 6.6/7, 6.8/7, 6.6/7)
- UG: IT in Business & Society: UG Core, NYU, Fall 2004. (Instructor Ratings: 6.2/7, 6.3/7)
- UG: MIS, CMU, Summer 2003. (Instructor Rating: 5/5).

### **PROFESSIONAL SERVICE (JOURNALS)**

- **Department Editor** – *Management Science* (July 2020 – Present)
- **Senior Editor** – *Information Systems Research* (September 2012 – December 2020)
- **Associate Editor** – *Management Science* (Jan 2009 – June 2020)
- **Associate Editor** – *Management Science* Special Issue on Business Analytics (August 2012)

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- **Associate Editor (Ad Hoc)** – *Management Science* (2008 – 2009)
- **Associate Editor** – *Information Systems Research* (Jan 2009 – December 2012)
- **Associate Editor (Ad Hoc)** – *MIS Quarterly* (2010 – Present)
- **Associate Editor** – *MIS Quarterly*, Special Issue on “Perspectives on Trust in Information Systems,” 2009
- **Editorial Board** – *Information Systems Research*, Special Issue on “Digital Systems & Competition,” 2008
- **Reviewer** – *American Economic Review*, *Decision Support Systems*, *Economic Theory*, *Electronic Commerce Research and Applications*, *IEEE Transactions on Knowledge and Data Engineering*, *International Journal of Electronic Commerce*, *Information Systems Research*, *International Journal of Industrial Organization*, *Journal of Economics and Management Strategy*, *Journal of Industrial Economics*, *Journal of Management Information Systems*, *Management Science (Information Systems)*, *Management Science (Marketing)*, *Marketing Science*, *Journal of Marketing Research*, *MIS Quarterly*, *Operations Research Letters*, *Production and Operations Management*
- **Panel Member** – *Hong Kong Research Grants Council* (2014 – 2020)

### **PROFESSIONAL SERVICE (CONFERENCES & WORKSHOPS)**

- **WISE Co-Chair** – Workshop on Information Systems and Economics (WISE), 2017, Seoul, December.
- **Track co-Chair** – E-Business and Mobile, International Conference on Information Systems (ICIS) 2016, Dublin.
- **Conference Co-Chair** – Workshop on Information Systems and Economics (WISE), 2014, Auckland, December.
- **Track co-Chair** – Economics of Information Systems, International Conference on Information Systems (ICIS) 2012, Orlando.
- **Senior Program Committee** – ACM Electronic Commerce Conference 2012, Spain, June.
- **Senior Program Committee** – ACM Electronic Commerce Conference 2011, San Jose, June.
- **Program Committee** – INFORMS Conference on Information Systems and Technology (CIST) 2012, October.
- **Program Committee** – INFORMS Conference on Information Systems and Technology (CIST) 2010, Austin, November.
- **Program Committee** – The First International Workshop on Opinion Mining for Business Intelligence (OMBI 2010), Toronto, August.
- **Program Committee** – Workshop on Social Media Analytics (SOMA 2010), Washington DC, July.
- **Program Committee** – ACM Electronic Commerce Conference 2010, Boston, June.
- **Conference Co-Chair** – INFORMS Conference on Information Systems and Technology (CIST), 2009, San Diego, October.
- **Conference Co-Chair** – Workshop on Information Systems and Economics (WISE), 2008, Paris, December.
- **Conference Co-Organizer** – First New York Computer Science and Economics Day (NYCE Day), 2008, September.
- **Steering Committee Member** – Second New York Computer Science and Economics Day (NYCE Day), 2009, November.
- **Conference Co-Chair** – Fourth Symposium on Statistical Challenges in Ecommerce Research



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(SCECR) 2008, NY, May.

- **Track Chair** – Pacific Asia Conference on Information Systems (PACIS) 2009, India, July (Ecommerce Track).
- **Track Chair** – Pacific Asia Conference on Information Systems (PACIS) 2008, China, July (Economics of Information Systems Track).
- **Associate Editor** – International Conference on Information Systems (ICIS) 2009, Phoenix, December (Economics of Information Systems Track).
- **Associate Editor** – International Conference on Information Systems (ICIS) 2008, Paris, December (Economics of Information Systems Track).
- **Associate Editor** – International Conference on Information Systems (ICIS) 2007, Montreal, December (*Web-Based Information Systems Track*).
- **Associate Editor** – International Conference on Information Systems (ICIS) 2007, Montreal, December (*Economics and Business Value of Information Systems Track*).
- **Program Committee** – ACM Electronic Commerce Conference 2009, Stanford, June.
- **Program Committee** – World Wide Web Conference 2009 (WWW), Spain, May.
- **Program Committee** – World Wide Web Conference 2008 (WWW), Beijing, May (*Social Networks and Web 2.0 Track and Internet Monetization Track*).
- **Program Committee** – International Conference on Web Search and Data Mining (WSDM) 2008, Stanford University, February.
- **Program Committee** – Workshop on Interdisciplinary Studies in Security and Privacy, 2008 (WISSP), NYU-Polytechnic, September.
- **Program Committee** – International Conference on Electronic Commerce 2007 (ICEC), Minnesota, August.
- **Program Committee** – Workshop on Economics of Information Security 2007 (WEIS), Pittsburgh, June.
- **Program Committee** – INFORMS Conference on Information Systems and Technology (CIST) 2007, Seattle, November.
- **Program Committee** – ACM Electronic Commerce Conference 2007, San Diego, June.
- **Program Committee** – International Conference on Decision Support Systems 2007, Kolkata, January.
- **Program Committee** – International Symposium of Information Systems 2006, Hyderabad, December.
- **Associate Editor** – International Conference on Information Systems 2006 (ICIS), Milwaukee, December (*Economics of Information Systems Track*).
- **Associate Editor** – International Conference on Information Systems 2006 (ICIS), Milwaukee, December (*General Track*).
- **Program Committee** – INFORMS Conference on Information Systems and Technology 2006 (CIST), Pittsburgh, November 2006.
- **Program Committee** – INFORMS Conference on Information Systems and Technology 2005 (CIST), San Francisco, November 2005.
- **Session Chair** – CIST 2008, WEIS 2007, June, Pittsburgh, ICDSS 2007, Kolkata, January, INFORMS 2006, (*ISR Sponsored Cluster*), Pittsburgh, November, INFORMS (*IS Economics Cluster*) 2005, San Francisco, November, INFORMS CIST 2005, San Francisco, November.
- **Discussant** – Workshop in Information Systems and Economics 2011 (Shanghai), Workshop in Information Systems and Economics 2010 (St. Louis), Workshop in Information Systems and

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Economics 2009 (Phoenix), International Industrial Organization Conference 2008 (Washington DC), International Conference on Information Systems 2007(Montreal), ZEW Workshop on ICT 2006 (Germany), Workshop in Information Systems and Economics 2006 (Evanston), Statistical Challenges in Electronic Commerce 2006 (Minneapolis), International Industrial Organization Conference 2006 (Boston), International Industrial Organization Conference 2005 (Atlanta), Workshop in Information Systems and Economics 2005 (Irvine).

### **UNIVERSITY SERVICE**

- NYU Senate 2020 – 2023
- NYU Senate Financial Affairs Committee 2020 – 2023
- Academic Director, Master in Business Analytics 2017 – Present
- Capstone Co-Director, Master in Business Analytics 2016 – Present
- Director, Center for Business Analytics 2015 – 2018
- Co-Director, Center for Business Analytics 2012 – 2015
- IOMS Core Curriculum Review Committee 2017 – 2018
- MBA Core Curriculum Review Committee 2016
- MSBA Curriculum Review Committee, 2015 – 2016
- External Review Committee, OPIM Department, Wharton School, 2015
- IOMS Executive Committee, 2013 – 2018
- Stern Dean's Faculty Advisory Committee, 2012 – Present
- Stern MBA Launch Committee, 2011 – 2014
- NYU Stern-Poly Collaboration Taskforce Committee, 2011
- Stern Doctoral Program Review Committee, 2010
- Stern Research Resources Committee, New York University, 2010 – Present
- Track Director for Interactive Marketing, CeDER, NYU Stern, 2009 – 2010
- Panel Judge in India Leadership Exchange Program Competition, 2009
- AACSB Review Junior Faculty Team, Stern School, 2009
- IS faculty member, Stern Undergraduate Honors Program, 2006 – 2012
- Ph.D. Committee, IOMS Department, Stern School, 2005 – 2006, 2009 – Present
- Coordinator, Information Systems Research Seminar series, Stern School, 2005 – 2007
- Stern School Team India Committee under Dean Kim Corfman, 2008 – 2009
- Panelist on “Life and Lifestyle for Untenured Faculty Members,” New Faculty Orientation at Stern School, New York University 2006, 2007, 2008
- Promotion & Tenure Review Committee, IOMS Department, Stern School, 2006
- Strategic Planning Meeting, Stern School, 2006
- Faculty Recruitment Committee, IOMS Department, Stern School, 2005 – 2006
- Panelist on “Effective Teaching Strategies,” New Faculty Orientation at NYU Stern, 2005
- Doctoral Student Committee, Carnegie Mellon University, 2002 – 2004

### **POST-DOCTORAL STUDENT SUPERVISION**

1. Dr. Hilah Levin (Post Doctoral Advisor, NYU, 2019 – 2020)

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2. Dr. Sang-Pil Han (Post Doctoral Advisor, NYU, 2008 – 2011) (Now Assistant Professor at Arizona State University)
3. Dr. Sung-Hyuk Park (Post Doctoral Advisor, NYU, 2012 – 2014) (Now Assistant Professor, KAIST)
4. Dr. Dominik Molitor (Post Doctoral Advisor), NYU, 2015 – 2016 (Now Assistant Professor at Fordham University)

**DOCTORAL STUDENT SUPERVISION**

1. Prasanna Parasurama – Stern School, (co-Chair) (Assistant Professor at Emory University)
2. Peiyan Yu – 5<sup>th</sup> year, Stern School, TOPS Department
3. Rubing Li – 4<sup>th</sup> year, Stern School, TOPS Department
4. Eunsol Cho – 4<sup>th</sup> year, Stern School, TOPS Department
5. Hongxian Huang – 2<sup>nd</sup> year, Stern School, Marketing Department
6. Hyesoo Lee – 1<sup>st</sup> year, Stern School, TOPS Department
7. Chenshuo Sun – Stern School (Chair), (now Assistant Professor at National University of Singapore)
8. Andrew Lee – KAIST (Thesis Committee), (now Assistant Professor at University of Texas at Dallas)
9. Carlos Fernandez – Stern School, (Thesis Committee), (now Assistant Professor at Hong Kong University of Science and Technology)
10. Shunyuan Zhang – Tepper School, Carnegie Mellon University (Thesis Committee), (Assistant Professor at Harvard Business School)
11. Vilma Todri – Stern School, (Chair), (Assistant Professor at Emory University)
12. Panos Adamopoulos – Stern School (Thesis Committee), (Assistant Professor at Emory University)
13. Xuan Ye – Stern School (Thesis Committee), (Assistant Professor at Boston College)
14. Yuqian Xu – Stern School (Thesis Committee), (Assistant Professor at University of Illinois at Urbana Champaign)
15. Jason Chan – Stern School (Chair), (Assistant Professor at Carlson School, University of Minnesota)
16. Beibei Li – Stern School, (co-Chair), (Assistant Professor at Carnegie Mellon University)
17. Gordon Burtch – Fox School of Business, Temple University (co-Chair), (Assistant Professor at Carlson School, University of Minnesota)
18. Yan Huang – Heinz College, Carnegie Mellon University (Thesis Committee), (Assistant Professor at Ross School, University of Michigan)
19. Ke-Wei Huang – Stern School, IOMS Department (Thesis Committee), (Assistant Professor at National University of Singapore)
20. Zheyin (Jane) Gu – Stern School, Marketing Department (Thesis Committee), (Assistant Professor at SUNY Albany)
21. Rong Zheng – Stern School, IOMS Department (Thesis Committee), (Assistant Professor at Hong Kong University of Science and Technology)
22. Manuel Arriaga – Stern School, IOMS Department (Thesis Committee), (Assistant Professor at Cambridge University)
23. Nikolay Archak – Stern School, IOMS Department (Thesis Committee), (Six Sigma)
24. Sanghee Bae – Stern School, Marketing Department (Thesis Committee)
25. Mingdi Xin – Stern School, IOMS Department (Proposal Committee), Graduated 2009 (now Assistant Professor at University of California at Irvine)
26. Akhmed Umyarov – Stern School, IOMS Department (Proposal Committee), Graduated 2010
27. Zubin Jelveh – 6<sup>th</sup> year Student, NYU Poly

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28. Wally Wang – 2<sup>nd</sup> year Student, Stern School, IOMS Department

### **UNDERGRADUATE STUDENT SUPERVISION**

1. Sanjana Gupta – Stern School (Undergraduate Honors Thesis Advisor)
2. Prita Kumar – Stern School (Undergraduate Honors Thesis Advisor)
3. Rohan Deshpande – Stern School (Undergraduate Project Advisor)
4. Pratik Mehta – Stern School (Undergraduate Honors Thesis Advisor)
5. Aileen Chua – Stern School (Undergraduate Honors Thesis Advisor)
6. Elliott Finch – Stern School (Undergraduate Honors Thesis Advisor)

### **PROFESSIONAL MEMBERSHIPS**

- **Research Council Member:** Wharton Customer Analytics Institute (2011 – 2017)
- **Scientific Advisory Board,** Hi! PARIS, France (2020 – Present)
- **Faculty Affiliate:** Marketing Science Institute (2008 – Present)
- **Member:** Association of Information Systems (AIS), Information Systems Society (ISS), INFORMS, Marketing Science Society, American Economic Association (AEA)

### **SELECTED CONSULTING & INDUSTRY ENGAGEMENTS**

Alibaba, Apple, Bank of Khartoum, W. R. Berkley Corporation, CBS, CTBC Taiwan, Dataxu (acquired by Roku), Delhivery, DFS Group, EYWAMEDIA, Facebook (Meta), Fox Corporation, Google, HCL-Hewlett Packard, HR Ratings Mexico, IBM, iBUS, Leverage Edu, Lucidity, Marico India, Microsoft, Netcore Cloud, NBCUniversal, OneVest, Pinterest, Recobell, Revenue Roll, Samsung, Shinsegae, Showtime, Snapchat, 3TI Solutions, Tamoco, TD Bank, Tinder, Travelocity, Verizon, Yahoo, ZeroWeb, 1-800 Contacts.

### **INDUSTRY POSITIONS**

2024 – Present	Board of Advisors, Black Hill Fund
2023 – Present	Board of Directors, Delhivery
2022 – Present	Advisor, Revenue Roll
2020 – Present	Senior Consultant (Affiliated Expert), Compass Lexecon
2020 – 2024	Governing Board of ICISA, Comptroller and Auditor General of India (CAG)
2020 – Present	Advisor, Scale Asia Ventures
2020 – 2021	Advisor, Trippal
2019 – 2022	Advisor, Netcore Cloud
2018 – 2024	Advisor, Tamoco
2018 – Present	Advisory Board, All India Gaming Federation
2018 – 2021	Advisor, Lucidity
2018 – 2019	Advisor, Adrealm
2018 – 2022	Advisor, ZeroWeb
2017 – Present	Advisor, Leverage Edu
2017 – Present	Advisor, iBUS

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2017 – Present	Advisor, EYWAMEDIA
2017 – 2020	Affiliated Scientific Expert, Analysis Group
2017 – 2020	Affiliated Scientific Expert, Keystone Strategy
2014 – 2020	Affiliated Scientific Expert, Cornerstone Research
2014 – 2018	Advisor, OneVest
2013 – 2017	Chief Data Scientist, 3TI Solutions
1999 – 2000	Senior Consultant, IBM
1998 – 1999	Business Development Manager, HCL-Hewlett Packard
1997	Management Trainee, Glaxo SmithKline Beecham

**SELECTED PRESS COVERAGE & OPINION PIECES**

1. *The Washington Post*, June 2024
2. *Fortune*, February 2024
3. *The Economic Times*, July 2023
4. *Poets & Quants*, June 2023
5. *The Washington Post*, April 2023
6. *ANA*, February 2023
7. *Yahoo Finance*, January 2023
8. *Yahoo Finance*, June 2022
9. *Vox*, June 2022
10. *NBC News*, February 2022
11. *Los Angeles Times*, February 2022
12. *NPR/Marketplace*, January 2022
13. *Forbes*, November 2021
14. *Consumer Reports*, November 2021
15. *Quartz*, August 2021
16. *CNN*, July 2021
17. *Quartz*, June 2021
18. *Quartz*, April 2021
19. *Campaign Asia*, March 2021
20. *Quartz*, March 2021
21. *Hindusthan Times*, March 2021
22. *Adweek*, December 2020
23. *Marketplace*, November 2020
24. *Adweek*, November 2020
25. *Business Insider*, October 2020
26. *Business Insider*, October 2020
27. *Quartz*, September 2020
28. *Business Because*, September 2020
29. *Quartz*, September 2020
30. *BBC*, July 2020
31. *Money Control*, June 2020
32. *Wall Street Journal*, May 2020

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33. *Yahoo Finance*, April 2020
34. *LiveMint*, April 2020
35. *The Economic Times*, April 2020
36. *Forbes*, April 2020
37. *LiveMint*, April 2020
38. *NDTV*, March 2020
39. *AdExchanger*, February 2020
40. *Campaign Asia*, February 2020
41. *Forbes*, January 2020
42. *Knowledge@Wharton*, December 2019
43. *Quartz*, December 2019
44. *Channel Futures*, December 2019
45. *Quartz*, December 2019
46. *Quartz*, November 2019
47. *The Economic Times*, July 2019
48. *CNN*, June 2019
49. *CNBC*, May 2019
50. *Marketplace*, April 2019
51. *Quartz*, April 2019
52. *Science Daily*, March 2019
53. *CNN*, March 2019
54. *Quartz*, February 2019
55. *CNBC*, January 2019
56. *The Quartz*, January 2018
57. *Forbes*, December 2018
58. *Science Daily*, November 2018
59. *Market Watch*, November 2018
60. *CNN*, September 2018
61. *CNBC*, September 2018
62. *Fox 4KC*, September 2018
63. *The Quartz*, September 2018
64. *Consumer Affairs*, September 2018
65. *NPR Marketplace*, September 2018
66. *The Quartz*, August 2018
67. *CNBC TV*, June 2018
68. *NASDAQ TV*, June 2018
69. *CNBCTV*, June 2018
70. *The Wall Street Journal*, June 2018
71. *AdAge India*, May 2018
72. *Harvard Business Review*, May 2018
73. *Adweek*, May 2018
74. *The Economic Times*, April 2018
75. *The Quartz*, April 2018

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76. *The Economic Times*, April 2018
77. *INC*, March 2018
78. *The Quartz*, March 2018
79. *The Quartz*, February 2018
80. *The Washington Post*, January 2018
81. *Voice of America*, January 2018
82. *Associated Press*, January 2018
83. *The Economic Times*, January 2018
84. *The Quartz*, January 2018
85. *The Entrepreneur*, December 2017
86. *US News*, December 2017
87. *The Quartz*, December 2017
88. *DBR Korea*, December 2017
89. *Hankyung Korea*, December 2017
90. *MarketWatch*, November 2017
91. *mHealthIntelligence*, November 2017
92. *The Quartz*, October 2017
93. *Engadget*, September 2017
94. *NBC News*, August 2017
95. *Business Insider*, August 2017
96. *The Globe and Mail*, July 2017
97. *Bloomberg View*, June 2017
98. *The Economic Times*, June 2017
99. *MarketWatch*, June 2017
100. *The Economic Times*, May 2017
101. *The Quartz*, May 2017
102. *CNBC*, April 2017
103. *ReCode*, April 2017
104. *The Economic Times*, April 2017
105. *AdExchanger*, April 2017
106. *The Quartz*, March 2017
107. *NPR Marketplace*, January 2017
108. *The Quartz*, January 2017
109. *Knowledge at Wharton*, January 2017
110. *Market Watch*, December 2016
111. *The Quartz*, December 2016
112. *The Street*, December 2016
113. *NBC News*, November 2016
114. *Knowledge at Wharton*, November 2016
115. *WIRED*, November 2016
116. *San Francisco Chronicle*, October 2016
117. *CKGSB Knowledge*, October 2016
118. *ABC News*, October 2016



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119. *WIRED*, October 2016
120. *The New York Post*, September 2016
121. *NPR Marketplace*, September 2016
122. *NPR Marketplace*, July 2016
123. *The Quartz*, July 2016
124. *The Quartz*, May 2016
125. *The Quartz*, April 2016
126. *CNBC*, March 2016
127. *OZY*, March 2016
128. *The Daily Mail*, February 2016
129. *OZY*, February 2016
130. *Business Because*, December 2015
131. *Investors' Business Daily*, November 2016
132. *OZY*, November 2015
133. *NDTV*, September 2015
134. *The Entrepreneur*, August 2015
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**Expert Depositions and Testimony**

1. Deposition of Anindya Ghose, in *In re Facebook, Inc., IPO Securities and Derivative Litigation*, on behalf of *Facebook, Inc. and the Defendants*, United States District Court, Southern District of New York, Case No. 1:12-md-02389 (April 30, 2015).
2. Deposition of Anindya Ghose, in *In re Appraisal of AOL Inc.*, on behalf of *Petitioners*, Court of Chancery of the State of Delaware, Consolidated C.A. No. 11204-VCG (February 14, 2017).
3. Deposition of Anindya Ghose, in *In re Facebook, Inc., IPO Securities and Derivative Litigation*, on behalf of *Facebook, Inc. and the Defendants*, United States District Court, Southern District of New York, Case No. 1:12-md-02389 (February 22, 2017).
4. Trial Testimony of Anindya Ghose, in *In re Appraisal of AOL Inc.*, on behalf of *Petitioners*, Court of Chancery of the State of Delaware, Consolidated C.A. No. 11204-VCG (March 7, 2017).
5. Deposition of Anindya Ghose, in *Federal Trade Commission v. I-800 Contacts*, on behalf of *I-800 Contacts and the Defendants*, Docket No. 9372 (March 14, 2017).
6. Trial Testimony of Anindya Ghose, in the matter of determination of rates and terms for making and distributing phonorecords (phonorecords III) Docket No. 16-CRB-0003-PR (2018-2022) on behalf of *Apple, Inc.* (March 23, 2017).
7. Trial Testimony of Anindya Ghose, in the matter of determination of rates and terms for making and distributing phonorecords (phonorecords III) Docket No. 16-CRB-0003-PR (2018-2022) on behalf of *Apple, Inc.* (April 12, 2017).
8. Trial Testimony of Anindya Ghose, in *Federal Trade Commission v. I-800 Contacts*, on behalf of *I-800 Contacts and the Defendants*, Docket No. FTC-9372 (May 10, 2017).
9. Deposition of Anindya Ghose, in *Snapchat, Inc. v. Vaporstream*, on behalf of Snapchat and the Defendants, Case No. 2:17-cv-220 (June 6, 2018).
10. Deposition of Anindya Ghose, in *Fuse Chicken LLC v. Amazon.com*, on behalf of *Fuse Chicken*, Case No. 5:17-cv-01538 (January 14, 2019).
11. Deposition of Anindya Ghose, in *Natalia Karasik, et al. v. Yahoo! Inc., Yahoo! Canada Co., Oath, Altaba and Verizon*, on behalf of *Yahoo*, Court File No. CV-16-566248-00CP (August 27, 2019).
12. Deposition of Anindya Ghose, in *Social Tech v. Apple Inc.*, on behalf of *Apple*, Case No. 3:18-cv-05945-VC (September 18, 2019).
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Case No. 2:17-cv-03679-SVWAGR (December 16, 2019).

14. Trial Testimony of Anindya Ghose, in *Marcus Wide of Grant Thornton (British Virgin Islands) Ltd. and Hugh Dickson of Grant Thornton Spst. Services (Cayman) Ltd., as joint liquidators of Stanford International Bank v. Toronto-Dominion Bank* litigation, on behalf of *TD Bank* (March 9-10, 2021).
15. Deposition of Anindya Ghose, in *Sean Rad et al. v. IAC/Interactivecorp, Match Group, Inc., and Match Group, LLC*, on behalf of *Tinder Plaintiffs*, Case No. 654038/2018 (June 7, 2021).
16. Deposition of Anindya Ghose, in *District of Columbia v. Facebook, Inc.*, on behalf of *Facebook, Inc.*, Case No. 2018 CA 008715 B (March 22, 2022).
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19. Deposition of Anindya Ghose, in *Rodriguez et al. v. Alphabet (Google)*, on behalf of *Alphabet (Google)*, Case No. 3:20-cv-04688-RS (July 13, 2023).
20. Deposition of Anindya Ghose, in *Federal Trade Commission v. Meta Platforms, Inc.*, on behalf of *Meta Platforms*, Case No. 1:20-cv-03590-JEB (January 29, 2024).
21. Deposition of Anindya Ghose, in *United States of America, et al. v. Google LLC*, on behalf of *Google LLC*, Case No. 1:23-cv-00108-LMB-JFA (March 6, 2024).
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23. Deposition of Anindya Ghose, in *Smartmatic USA Corp, Smartmatic International Holding B.V., and SGO Corporation Limited v. Fox Corporation, Fox News Network LLC, Lou Dobbs, Maria Bartiromo, Jeanine Pirro, and Sidney Powell*, on behalf of *Fox Corporation*, Case No. 151136/2021 (June 13, 2024).
24. Deposition of Anindya Ghose, in *Martinez v. Pinterest, Inc. et al.*, on behalf of *Pinterest*, Case No. RG21112456 (July 10, 2024).

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## APPENDIX B

### Materials Relied Upon

#### Court Documents

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- Deposition of Google ([REDACTED]), *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, April 5, 2024.
- Deposition of Google ([REDACTED]), *The State of Texas, et al. v. Google LLC*, U.S. District Court, Eastern District of Texas, Case No. 4:20-cv-00957-SDJ, May 2, 2024.
- [REDACTED]
- [REDACTED]
- [REDACTED]
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### **Bates-Stamped Documents and Data**

- [REDACTED].
- [REDACTED].
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- [REDACTED]
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- GOOG-AT-DOJ-DATA-000247044.
- GOOG-AT-MDL-003537710.
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- GOOG-DOJ-AT-01570215.
- GOOG-DOJ-AT-02096475.

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## **APPENDIX B**

### **Other**

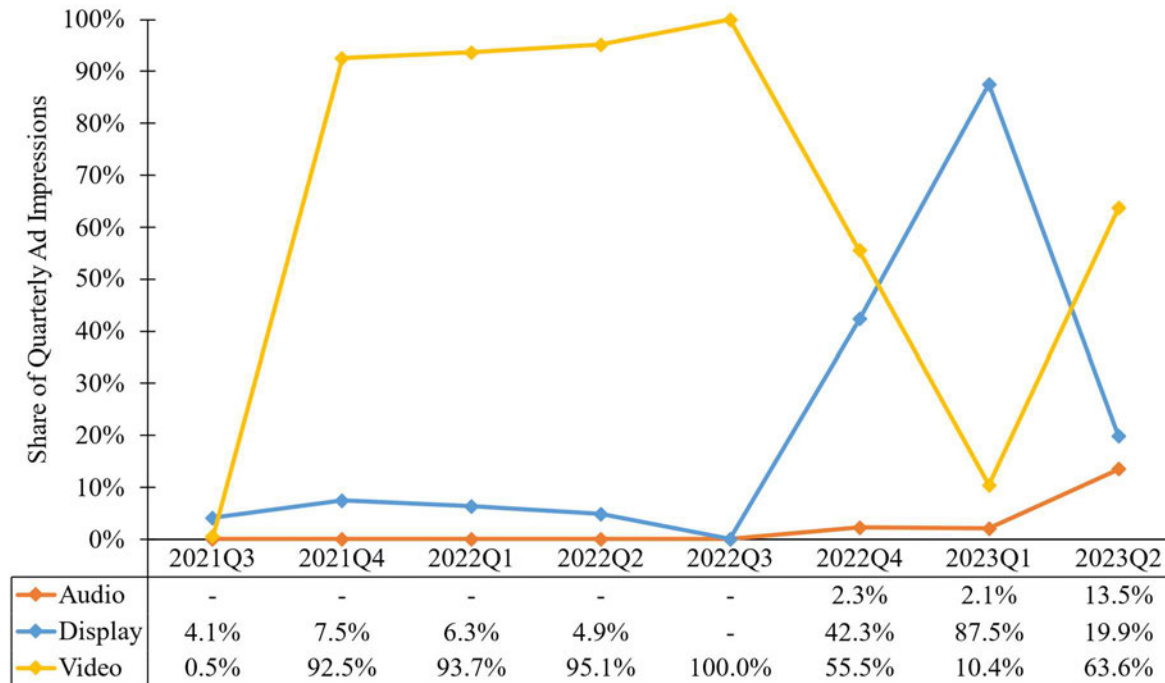
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## APPENDIX C

**Figure C-1. Share of Ad Impressions by Nike North America Brand, by Media Type, 2021Q3-2023Q2**



**Notes:**

[1] Data also include impressions for “Unknown Media Type.” I include these data in my calculations, but not in the figure above. As such, the shares may not add up to 100% for each quarter across the media types presented above.

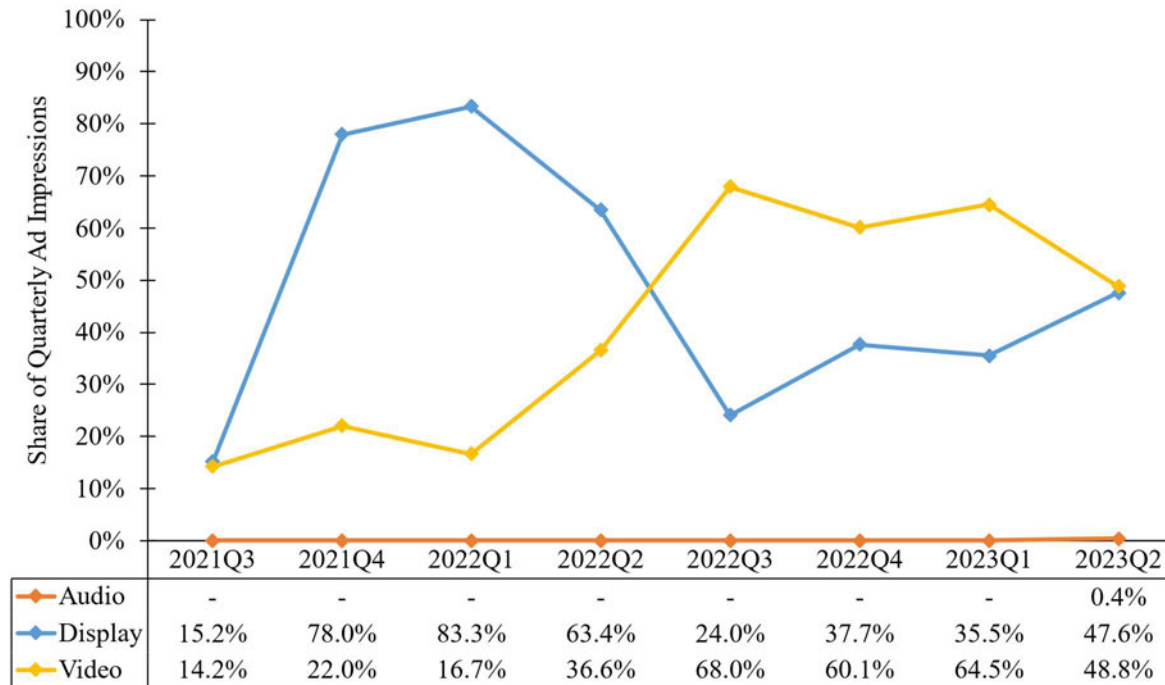
[2] Data also include impressions for “Tracking” ads, which I exclude from my analysis. These ads only help advertisers track clicks and impressions instead of delivering visible content. See “Ads overview,” *Campaign Manager 360 Help*, available at <https://support.google.com/campaignmanager/answer/2837647?hl=en>.

[3] Based on impressions for users in the United States, for the advertiser named “Nike North America Brand.”

[4] Entries with “-” denote data unavailable in the corresponding category/period.

**Source:** Campaign Manager data produced as GOOG-AT-DOJ-DATA-000247044.



**APPENDIX C****Figure C-2. Share of Ad Impressions by Macy’s Media Network, by Media Type, 2021Q3-2023Q2****Notes:**

[1] Data also include impressions for “Unknown Media Type.” I include these data in my calculations, but not in the figure above. As such, the shares may not add up to 100% for each quarter across the media types presented above.

[2] Data also include impressions for “Tracking” ads, which I exclude from my analysis. These ads only help advertisers track clicks and impressions instead of delivering visible content. See “Ads overview,” *Campaign Manager 360 Help*, available at <https://support.google.com/campaignmanager/answer/2837647?hl=en>.

[3] Based on impressions for users in the United States, for the advertiser named “Macy’s Media Network (MMN).”

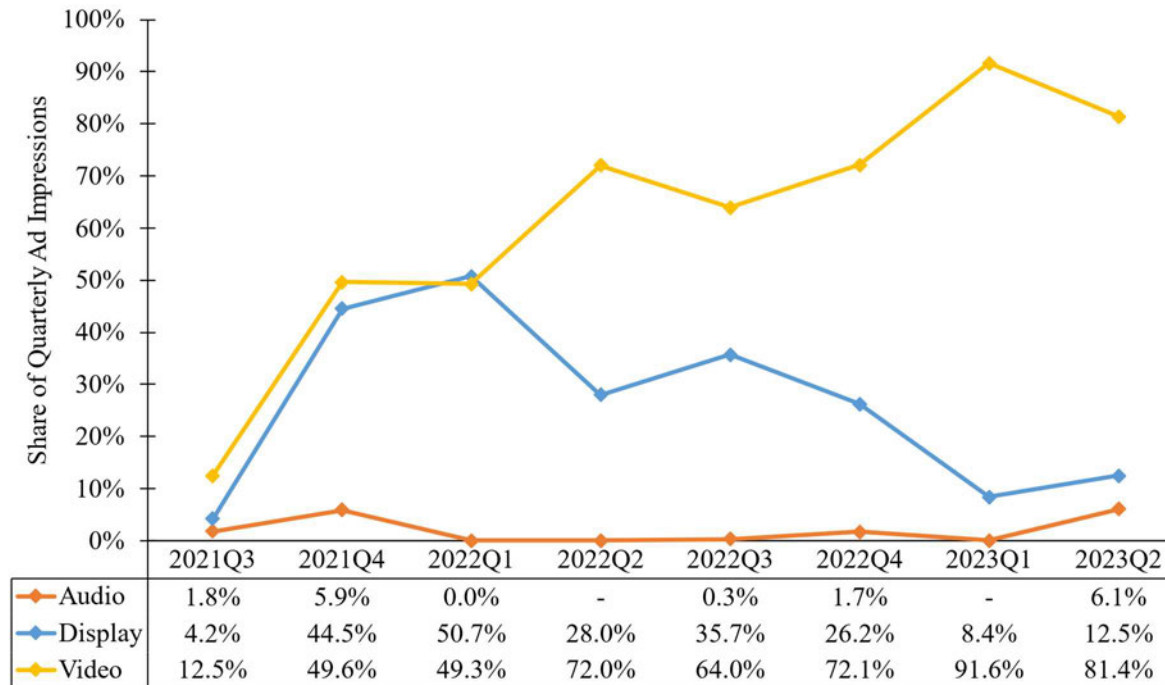
[4] Entries with “-” denote data unavailable in the corresponding category/period.

**Source:** Campaign Manager data produced as GOOG-AT-DOJ-DATA-000247044.

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## APPENDIX C

**Figure C-3. Share of Ad Impressions by American Express – Global Advertising, by Media Type, 2021Q3-2023Q2**



**Notes:**

[1] Data also include impressions for “Unknown Media Type.” I include these data in my calculations, but not in the figure above. As such, the shares may not add up to 100% for each quarter across the media types presented above.

[2] Data also include impressions for “Tracking” ads, which I exclude from my analysis. These ads only help advertisers track clicks and impressions instead of delivering visible content. See “Ads overview,” *Campaign Manager 360 Help*, available at <https://support.google.com/campaignmanager/answer/2837647?hl=en>.

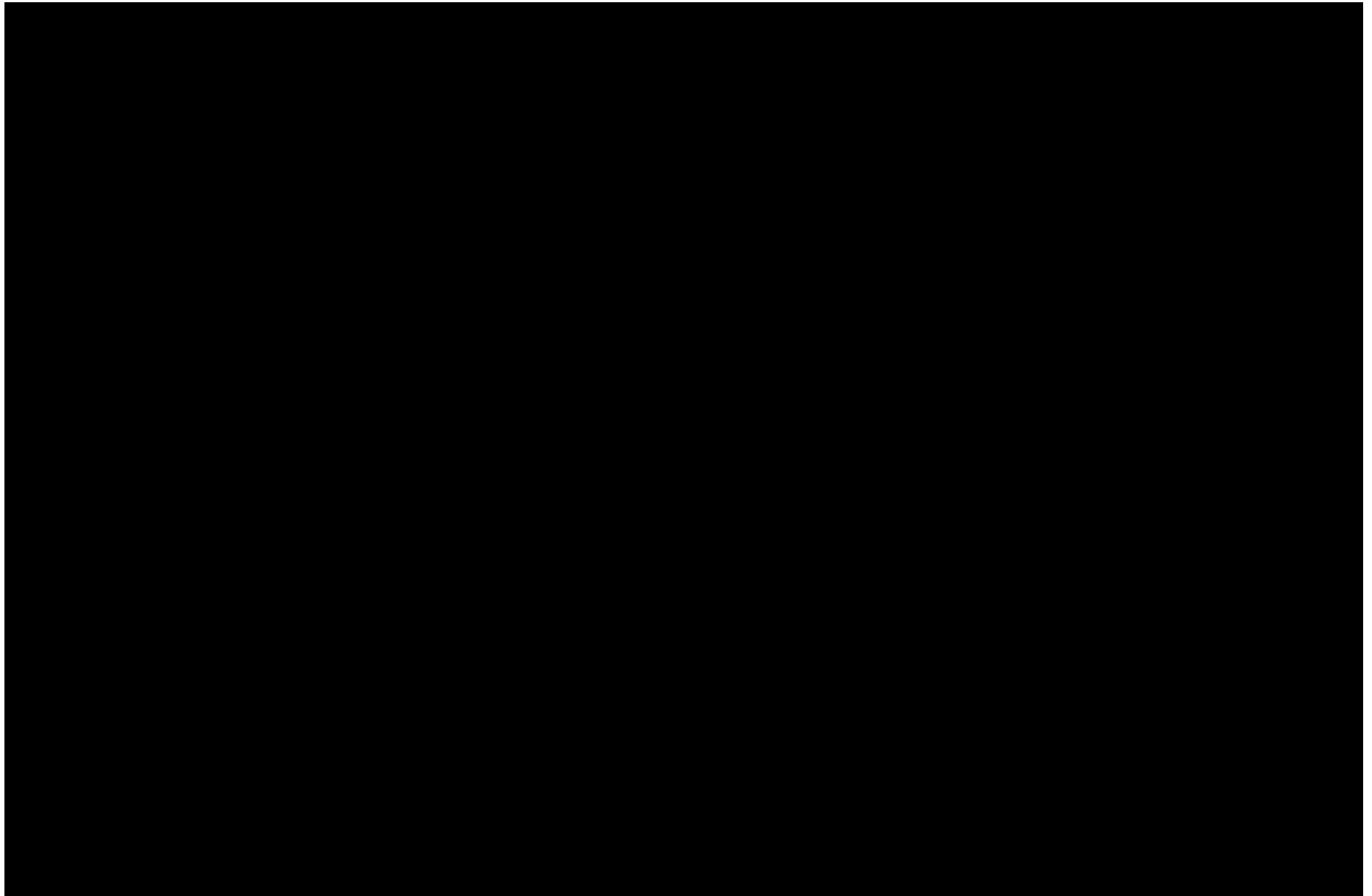
[3] Based on impressions for users in the United States, for the advertiser named “Amex - Global Advertising.”

[4] Entries with “-” denote data unavailable in the corresponding category/period.

**Source:** Campaign Manager data produced as GOOG-AT-DOJ-DATA-000247044.

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**APPENDIX C**



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## **APPENDIX D**

**Figure D-1. Direct Deals Replicate Offline Advertising**



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## **APPENDIX D**

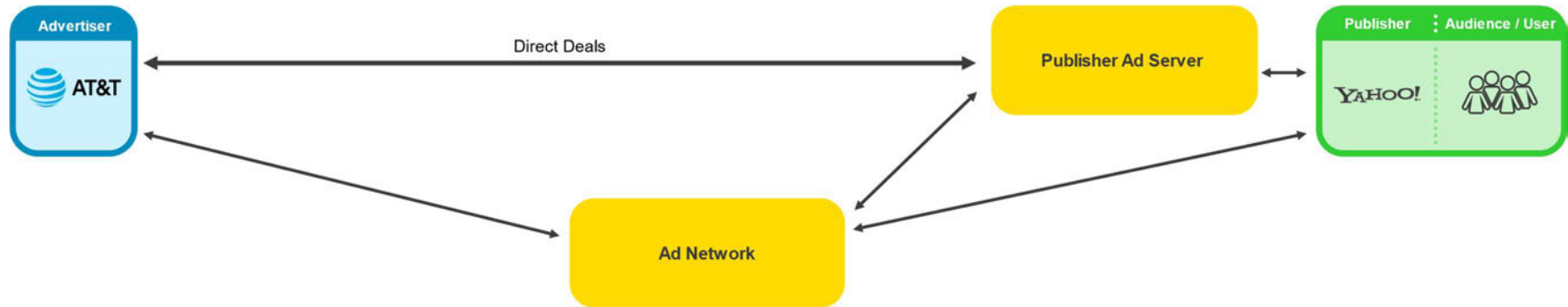
**Figure D-2. Publishers and Advertisers Adopt Ad Servers to Manage Display Advertising Processes**



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## **APPENDIX D**

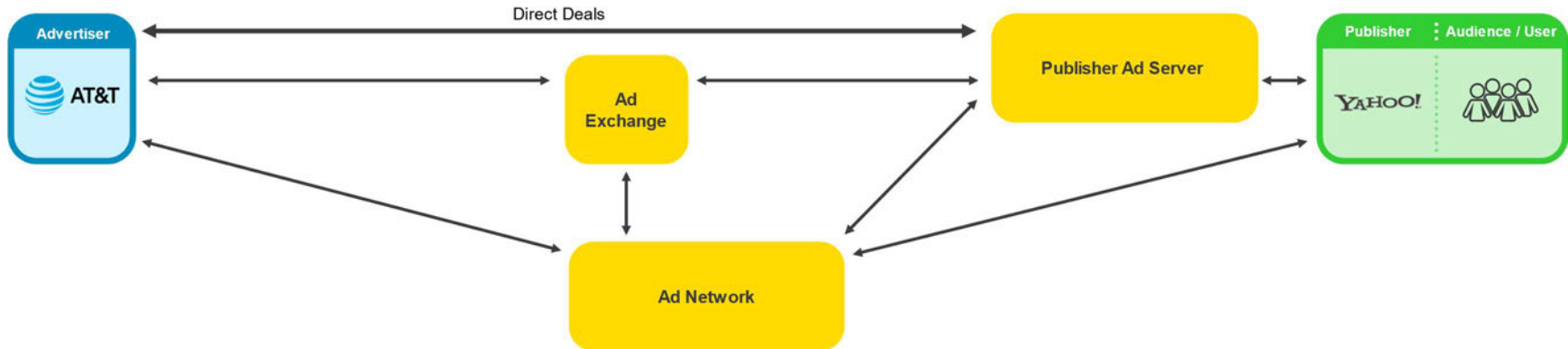
**Figure D-3. Ad Networks Aggregate and Resell Remnant Inventory**



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## **APPENDIX D**

**Figure D-4. Ad Exchanges Enable Programmatic Transactions**

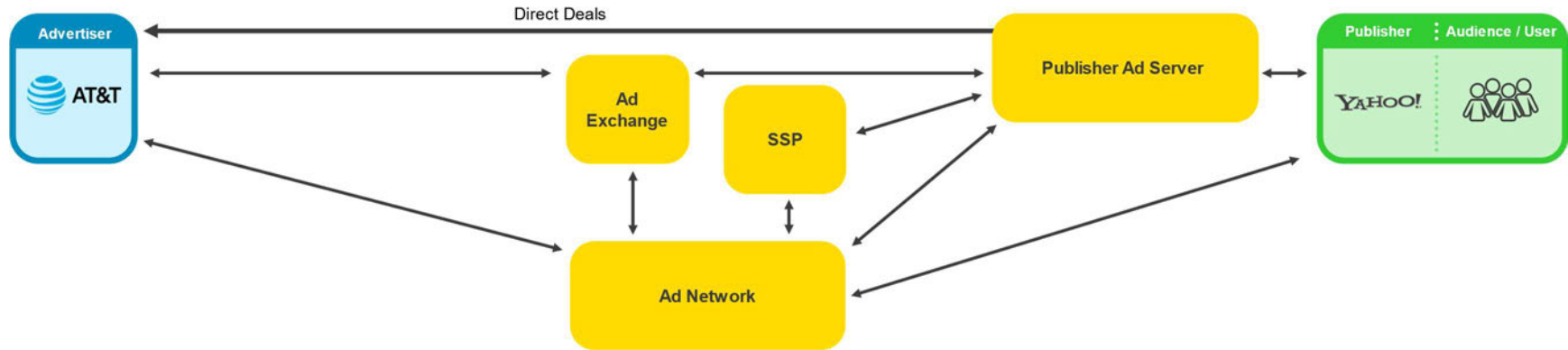




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## **APPENDIX D**

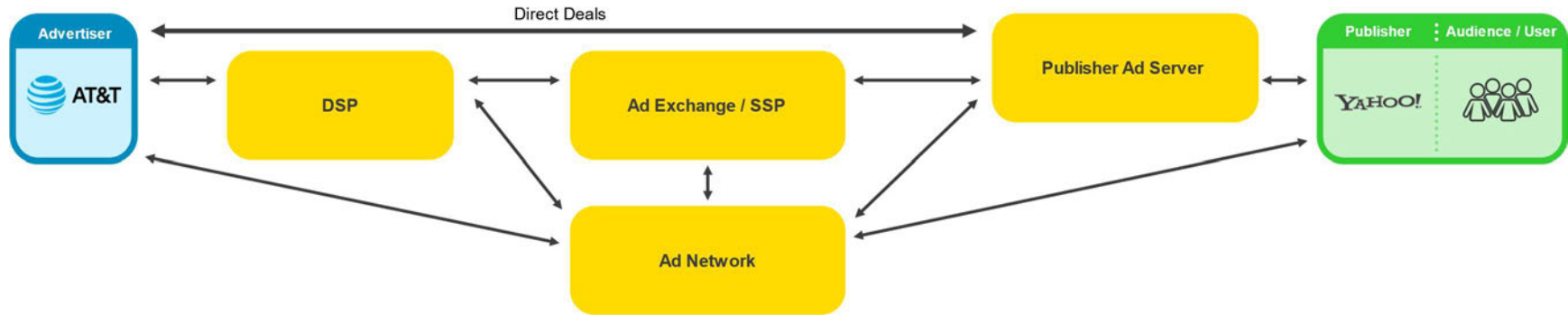
**Figure D-5. Supply-Side Platforms Help Publishers Optimize Yield**



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## **APPENDIX D**

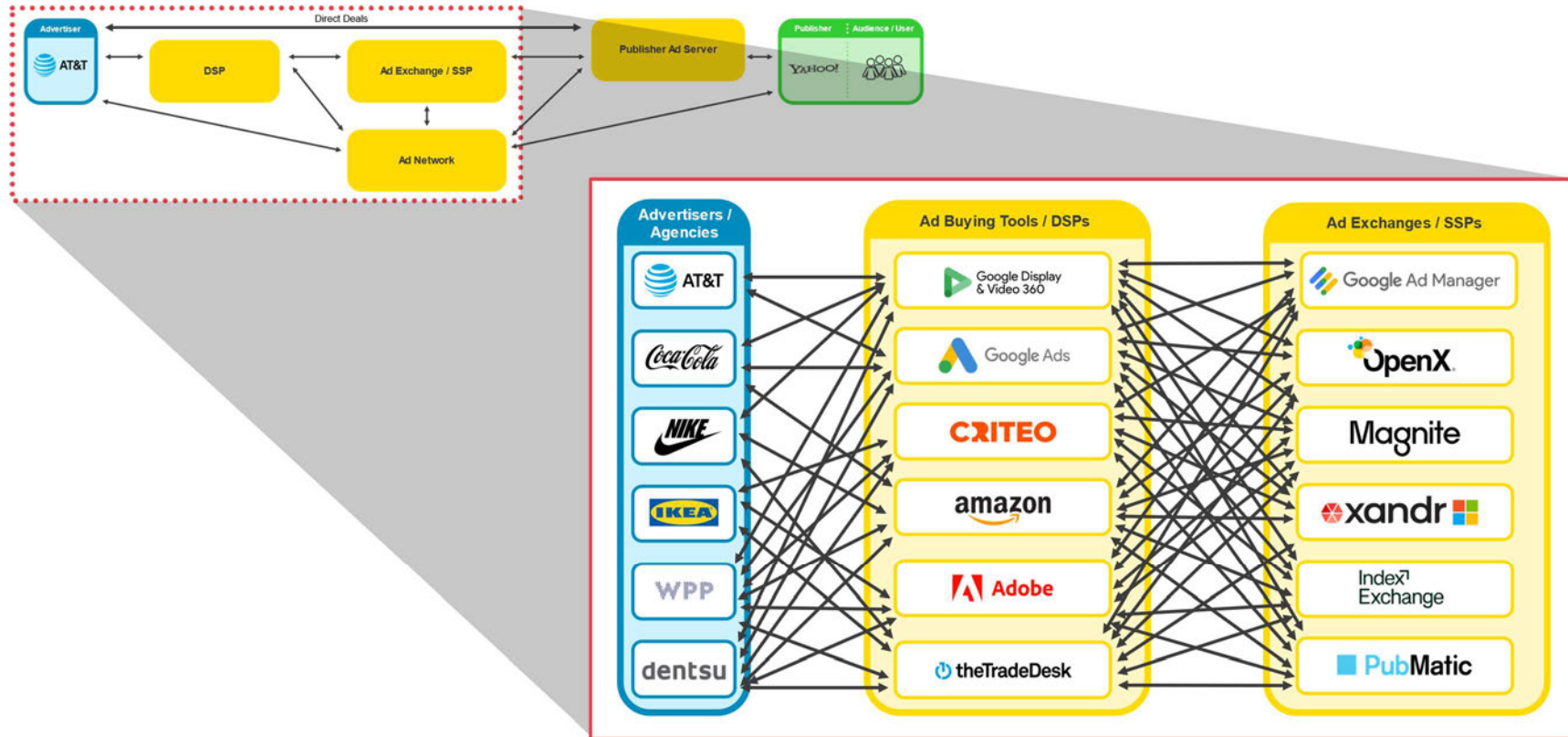
**Figure D-6. Introduction of Real-Time Bidding and Emergence of DSPs**

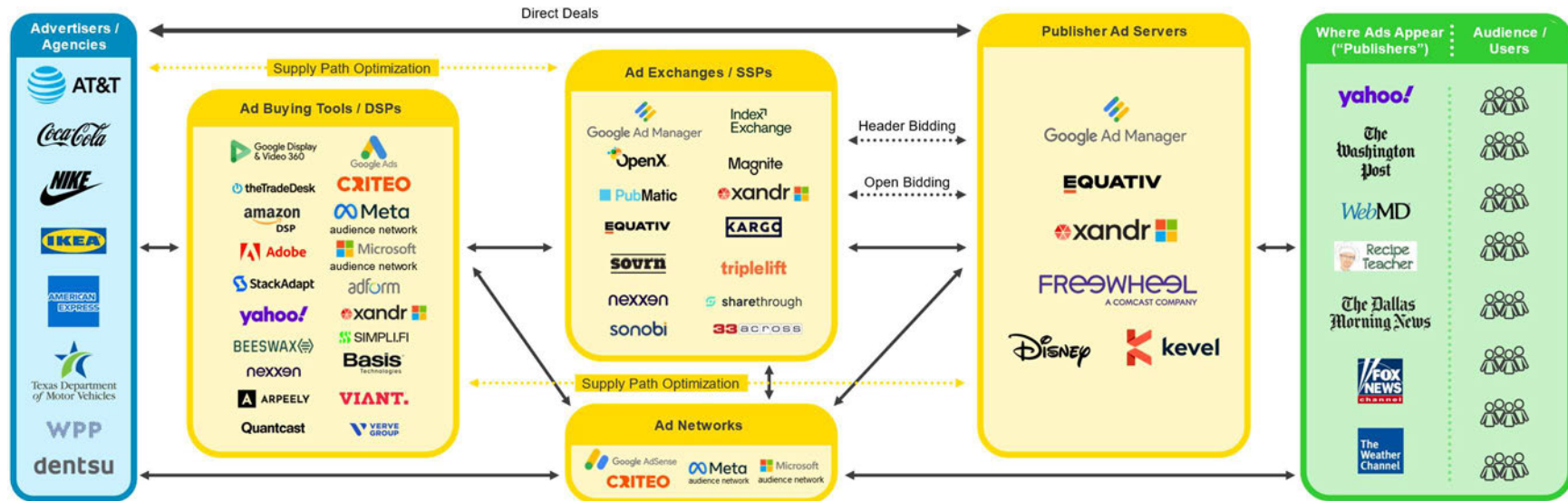


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## APPENDIX D

Figure D-7. Illustrative Example of Possible Bidding Paths on an Impression



**APPENDIX D****Figure D-8. Examples of Firms Offering “Open Web” Ad Tech Tools**

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## APPENDIX D

Figure D-9. Plaintiffs Focus on a Fraction of Display Ad Spending

